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***TM 8–230**

TECHNICAL MANUAL No. 8–230

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MEDICAL CORPSMAN AND MEDICAL SPECIALIST

***This manual supersedes TM 8–230, 2 August 1950, including C 1, 4 January 1954.**

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Purpose and Scope

a. This manual is intended primarily for use in training the medical corpsman, MOS code 910, and the medical specialist, MOS code 911.1, in the medical skills and knowledges required by AR 611–201.

b. The manual discusses the following major subjects: development of the Army Medical Service; care of medical supply and equipment; medical records and reports; anatomy and physiology; emergency medical care and treatment; pharmacology and materia medica; dispensary medical service; symptom recognition; ward management; basic nursing care; special procedures in nursing care; and special patient care and related procedures. Appendix I lists Department of the Army publications referred to in the manual. Appendix II discusses the construction of medical terms and contains a glossary of medical terms. Appendix III lists abbreviations used in the preparation and administration of drugs.

c. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to The Surgeon General, Department of the Army, Washington 25, D.C.

2. Applicability to Types of Warfare

The material in this manual is applicable without modification to both nuclear and nonnuclear warfare.

Section II. DEVELOPMENT OF THE ARMY MEDICAL SERVICE

3. General

As a medical soldier you belong to a branch of the Army with a long history of service and achievement. It is not practical to include in this manual the whole story of the Army Medical Service,

but as matters of special interest to you, some of the more important events in its development are summarized below.

4. The Revolutionary War

a. When the forces of the thirteen colonies united under one command on 14 June 1775, the United States Army was created. On 27 July 1775, the Continental Congress established a Hospital Department in the Army to care for the sick and wounded. The Hospital Department was composed of one director general and chief physician, four surgeons, one apothecary, 20 surgeon's mates, one clerk, two storekeepers, one nurse for every 10 patients, and incidental laborers as needed. That small organization was the Army's first step toward a central medical service.

b. The Hospital Department functioned throughout the Revolutionary War, but it was not the Army's only medical service. The Army was divided into several military departments and each department maintained its own medical service. Altogether about 1,200 medical practitioners joined the American colonists in their fight for freedom. Their efforts to provide adequate medical service were heroic but unsuccessful. There was no organized system of evacuating casualties. Treatment facilities were few and poorly equipped. Methods for prevention and control of communicable diseases were practically unknown. Many more soldiers died of disease than of battle wounds. But Army doctors came out of the Revolutionary War with new knowledge of treatment of sick and wounded and of military sanitation.

5. The War of 1812

The Hospital Department, disbanded at the end of the Revolutionary War, was reactivated during the War of 1812. During this war, medical officers for the first time were given uniforms and the first Army Regulations on duties of medical officers were issued. Still the Hospital Department was hampered by lack of centralized control of medical facilities and by shortages of supplies and personnel. Many of the same shortcomings in medical service experienced by the Army during the Revolutionary War were evident in the War of 1812.

6. Establishment of Army Medical Department

The year 1818 marked the beginning of a central medical organization in the Army. Congress reorganized the staff departments of the Regular Army and included in it a Medical Department to be headed by a Surgeon General. General Orders dated 21 April 1818 actually established the Medical Department. Since then medical service in the Army has maintained status as a staff department directed by a Surgeon General.

7. Organization of Medical Enlisted Force

The Army's first organized medical enlisted force was created in 1856 when Congress authorized the appointment of hospital stewards in the Medical Department. Hospital stewards were qualified non-commissioned officers who served as pharmacists, property men, record keepers, and wardmasters. They were assisted by enlisted men detailed from the line who served as nurses and attendants and received extra pay for this work.

8. The Civil War

During the Civil War, as in earlier wars, disease and wound infection were greater killers than gunfire. Nevertheless, important developments in combat medical service were produced. Among these were the field hospital, a better system of medical supply, the first convalescent camp, and most outstanding, a system of evacuating battle casualties. The system was devised by an Army doctor, Jonathan Letterman. It included the use of field aid stations, ambulances, field hospitals, hospital trains and general hospitals. Tried first at the Battle of Antietam in 1862, the Letterman Plan proved so efficient that it was adopted Armywide. The general principles of this system of evacuation are still in use.

9. Establishment of the Hospital Corps

During the peacetime period, 1865 to 1898, the event of greatest interest to medical enlisted men occurred in 1887 when the Hospital Corps was established in the Medical Department. Thus, for the first time men could be enlisted and trained exclusively for permanent duty with the Medical Department. The Hospitals Corps was composed at first of hospital stewards, assistant hospital stewards, and privates. The title "hospital steward" was eliminated in 1903 when the corps was reorganized to consist of sergeants first class, corporals, privates first class, and privates.

10. Developments Between 1900 and 1916

Between 1900 and 1916, the basic organization of the Medical Department was enlarged so that for the first time the department had a broad framework on which to prepare for war. The Nurse Corps was established in 1901, followed by the Medical Reserve Corps in 1908, the Dental Corps in 1911, and the Veterinary Corps in 1916. In addition, in 1916, a Medical Department enlisted force was substituted for the old Hospital Corps, whose members were transferred to the Medical Department.

11. World War I

a. When the United States entered the war on 6 April 1917, the Medical Department began an unprecedented expansion of its per-

sonnel and activities. Two separate types of medical service were established—(1) medical service in a theater of operations and (2) medical service in the zone of interior. A Sanitary Corps was organized with officers commissioned from enlisted or civilian ranks. Although not professional medical men, these officers had training which made them valuable in sanitary engineering, laboratory work, medical administrative or supply duties. The Sanitary Corps was the forerunner of the Medical Administrative Corps created in 1920. During World War I, the Medical Department reached a total strength of about 350,000, while the Army grew from 100,000 to a peak of four million men in 1918.

b. The great size of the Army, the vast scale of combat operations, and the remoteness of the battlefronts posed new and complex military medical problems. Nevertheless, the Medical Department gave outstanding service in both the United States and the theaters of operations. Besides giving medical treatment to the sick and wounded, the Medical Department made a fine record in the control of diseases among Army personnel in World War I. Despite a fatal influenza epidemic, the ratio of deaths due to diseases to deaths due to battle action was reduced to only slightly more than one to one. World War I produced other advances in Army medicine. Casualty evacuation was improved. Mobile hospitals and surgical teams were introduced. The wounded got better and faster medical treatment. In surgery two types of wound treatment came into use, debridement and the antiseptic treatment with chlorine solutions.

12. World War II

a. World War II brought with it a return, on a much larger scale, of many of the problems encountered in World War I. It brought new medical problems, too, such as those involved in the amphibious and aerial invasion of Europe. This time the nation fought a global war, the peak strength of the Army reached eight million men, and war lasted four years.

b. During World War II, the Medical Department reached a total strength of more than 600,000. In 1942, members of the Army Nurse Corps were granted definite military rank. Other female officers were commissioned in the Medical Department in the specialties of physical therapy and dietetics. In 1943, the Pharmacy Corps was established. Nonregular Army members of the Medical Administrative Corps, like the Sanitary Corps, became a reserve component. Regular Army members of the Medical Administrative Corps became members of the Pharmacy Corps.

c. The conduct of large scale combat operations in widely separated areas of the world resulted in an unprecedented variety of medical problems. Yet the service given by the Army Medical Department in World War II surpassed all previous records of success

in military medicine. For the first time, deaths due to disease were less than deaths due to battle injuries. This was true despite the fact that deaths from wounds were kept to a new low.

d. Many wartime advances in medical service contributed to the Medical Department's success in conserving Army fighting strength. Great improvements were made in methods of evacuating casualties. Ambulances, hospital ships, and hospital trains were used more than ever before. New means of air evacuation were introduced, and by the end of the war, air evacuation of casualties was common practice. There was better management of wounds at all levels of medical service, especially in forward combat areas. Penicillin and improved surgical techniques virtually eliminated wound infection. Plasma and blood transfusions were used widely and saved many lives. Methods of treatment of burns improved as the war progressed. Psychiatry was used more widely than ever before to maintain the mental health of troops.

e. Perhaps the most impressive developments in Army medical service during World War II were those in preventive medicine. The Medical Department developed and applied many measures for the prevention and control of disease to safeguard the health of the Army. One of the most significant measures was the use of DDT in the control of malaria. Other disease prevention measures included sanitary surveys of all sites chosen for military installations; use of halazone tablets and the diatomaceous earth filter for water purification; health education for individual control of disease; and immunization agents for typhus fever, yellow fever, typhoid, cholera, and several other diseases. The drug, atabrine, was found to be an effective substitute for quinine in the treatment of malaria. The discovery of new drugs for the treatment of cholera, amebiasis, filariasis, and schistosomiasis also contributed to disease control.

13. Postwar Medical Service

After World War II, the Medical Department, like all of the Army, was reduced in numbers. But its responsibilities continued to be global. Medical support was furnished wherever our military forces were stationed. Progressive training of Medical Service personnel was resumed on a peacetime basis, and research and development of new equipment were continued. In 1947, Congress established two new corps in the Regular Army Medical Department: the Medical Service Corps, which replaced and incorporated the former Medical Administrative, Sanitary, and Pharmacy Corps; and the Women's Medical Specialist Corps which included dietitians, physical therapists, and occupational therapists. Then the Army Organization Act of 1950 specified that medical service in the Army would consist of The Surgeon General, the Assistant Surgeons General, the Medical Corps, the Dental Corps, the Medical Service Corps, the

Army Nurse Corps, and the Women's Medical Specialist Corps (redesignated in 1955 the Army Medical Specialist Corps). These components, collectively, were officially named the "Army Medical Service."

14. Army Medical Service in Korea

With the outbreak of war in Korea and the concurrent expansion of the Army, medical field service training was resumed on a full-scale basis. Thousands of Army Medical Service officers and enlisted men were prepared for and assigned to duty overseas. An important development of this period was the use of helicopters for ambulance service. Casualties who could not be evacuated by other means were brought to medical treatment facilities by helicopter in the shortest possible time. This saved many lives which otherwise would have been lost. Since then, helicopter ambulance units have become a permanent element of the Army Medical Service. Rapid evacuation of casualties, the efficient use of latest developments in medicine, and the teamwork of medical personnel made possible the saving of 97.4 percent of the wounded who survived long enough to be brought to a frontline treatment facility—surpassing by two percent the life-saving record established by the Medical Department in World War II.

Section III. CARE OF MEDICAL SUPPLIES AND EQUIPMENT

15. Definition of Terms

a. Supplies. Supplies are all items necessary for the equipment, maintenance, and operation of a military command.

b. Expendable Supplies. These are items which are consumed in use or lose their identity during use. Bandages, drugs, and dressings are examples of expendable supplies.

c. Nonexpendable Supplies. These are items which are not consumed in use and do not lose their identity in use. Surgical instruments are examples of nonexpendable supplies.

d. Property Exchange. This is the exchange of like items between units evacuating patients.

16. Care of Medical Supplies and Equipment in General

a. Drugs. Narcotics and poisons must be kept in a locked cabinet. Serums, vaccines, antitoxins, and suppositories must be kept in a refrigerator. Flammable preparations should be stored in a cool place.

b. Instruments. Care of instruments includes keeping them clean and dry, protecting cutting surfaces, and preventing rust in hinged instruments.

c. Rubber Goods. Usefulness of gloves, catheters, and rubber tubing is prolonged by keeping them free of oils and greases and away

from excessive heat, light, and strong chemicals. Before sterilizing, rubber goods should be thoroughly cleaned with soap and water. Rubber gloves must be thoroughly dried and powdered with talc before they are put in the autoclave (sterilizer). Rubber goods should not be placed in contact with metal surfaces of the autoclave.

d. Ward Supplies and Equipment. See paragraphs 350 through 355.

17. Surgical Instrument and Supply Set, Individual

a. General. In combat, this set is issued to the aid man. It is contained in a waterproof canvas case. The case has four compartments and an adjustable web carrying strap.

b. Care of Set and Contents.

(1) The aid man should keep contents of the set up to authorized level so that he has enough supplies to treat casualties.

(2) He should arrange items in the compartments so that he knows where each is kept.

(3) He should keep all items intact until they are ready for use.

(4) Surgical instruments should be cleaned and lubricated lightly when not in use.

c. Contents of Set. The set contains drugs, bandages and first aid dressings, adhesive plaster, bandage and surgical scissors, tourniquet, oral clinical thermometer, instruments for minor surgery, pencil, and book of emergency medical tags. Normally, the drugs are acetylsalicylic acid (aspirin) tablets, morphine syrettes (¼ grain), tetracaine ophthalmic ointment, and benzalkonium chloride tincture. (Because of restrictions on dispensing narcotics morphine syrettes sometimes are not included in individual instrument sets used in training areas.) See paragraphs 262 through 283 for uses of drugs.

18. Surgical Instrument and Supply Set, Combat

a. This set is authorized for battle group aid stations and clearing companies. It is packed in an aluminum chest with items separated in sections by class and use. The set contains drugs, bandages, dressings, tourniquet, pharyngeal airways, surgical instruments, boiling type instrument sterilizer, dressing sterilizer, record book, and emergency medical tags.

b. Drugs in the set include the following: acetylsalicylic acid (aspirin), alcohol, dextro amphetamine sulfate, bismuth subcarbonate, cascara sagrada extract, codeine sulfate, epinephrine, morphine, thiopental sodium, secobarbital sodium, sulfadiazine, tetracaine ophthalmic ointment, benzethonium chloride, benzoin tincture, and lidocaine hydrochloride. See paragraphs 262 through 283 for uses of the drugs.

19. Medical Instrument and Supply Set, Dispensary, Field

a. This set is found in battle group aid stations and division clearing stations. It is packed in an aluminum chest divided into

two compartments. The set contains the various drugs, bandages, diagnostic equipment, and surgical instruments required to furnish dispensary (outpatient) medical service.

b. Drugs in the set include the following: acetylsalicylic acid (aspirin), alcohol, bismuth subcarbonate, calamine lotion, cascara sagrada extract, codeine sulfate, meta cresylacetate, diphenhydramine hydrochloride, magnesium sulfate (Epsom salt), ammoniated mercury ointment, petrolatum, liquid petrolatum, phenobarbital, potassium permanganate, sodium bicarbonate, sulfadiazine, tetracaine ophthalmic ointment, zinc oxide ointment, ether, eugenol, phenylephrine hydrochloride, tetracaine ointment, benzethonium chloride, homatropine hydrochloride ophthalmic disks, methyl salicylate, sulfacetamide sodium ophthalmic ointment, gamma benzene hydrochloride ointment, amylnitrate procaine hydrochloride, fungicidal foot powder, and undecylenic acid ointment. See paragraphs 262 through 283, for uses of the drugs.

c. Among the diagnostic instruments in the set are an otoscope, an ophthalmoscope, a stethoscope, and an aneroid sphygmomanometer. The otoscope is used to inspect the ear, the ophthalmoscope, to inspect the interior of the eye. The stethoscope is used for detection and study of sounds arising within the body. The aneroid sphygmomanometer is used to measure blood pressure.

20. Medical Supply Set, Field, Supplemental Supplies

This set is authorized for battle group aid stations and division clearing companies. The set contains drugs, bandages, dressings, adhesive plaster, cartridge syringe, and a waterproof bag with shoulder strap. The drugs are dextran, morphine, penicillin, serum albumin, and nalorphine hydrochloride. Dextran and serum albumin are plasma volume expanders used to treat shock (par. 159). Morphine is used to relieve severe pain (par. 155). Penicillin is used for the prevention or treatment of infections, especially in open wounds and burns (par. 153). Nalorphine hydrochloride is useful as an antidote in the treatment of morphine poisoning.

21. Surgical Instrument and Supply Set, Shock Treatment, Field

This set is found in evacuation and mobile army surgical hospitals. It contains drugs, stethoscopes, aneroid sphygmomanometers, surgical instrument sterilizer, instruments and other items required for surgery. The drugs are alcohol, epinephrine, levarterenol bitartrate, serum albumin, dextran, dextrose, and dextrose and sodium chloride injection. Alcohol is used as an antiseptic (par. 271). Epinephrine is useful as a vasoconstrictor and a heart stimulant (par. 281). Levarterenol bitartrate is used to maintain blood pres-

sure in certain types of shock. See paragraph 159 for uses of serum albumin, dextran, dextrose, and dextrose with sodium chloride.

22. Medical Supply Set, Gas Casualty Treatment

a. This set is found in field and mobile army surgical hospitals and in gas detachments. The set contains items for treatment of patients suffering from lung irritants. Contents include the following: drugs, petrolatum impregnated gauze, dressing forceps, bandage scissors, Luer syringes, hypodermic needles, intratracheal catheters, pharyngeal airway, urethral catheters, syringe for bladder evacuation, protective gloves and aprons, and TM 8–285, Treatment of Chemical Warfare Casualties.

b. Drugs in the set include: amyl nitrite, dimercaprol, calamine lotion and powder, copper sufate, fluorescein sodium, petrolatum, tetracaine ophthalmic ointment, sulfacetamide sodium, eye and nose drops, atropine injection, atropine sulfate ointment, and homatropine hydrochloride ointment. Amyl nitrite is useful as an inhalant for treatment of poisoning by hydrocyanic acid or cyanogen chloride. Dimercaprol is injected for treatment of arsenic poisoning. Copper sulfate solution is used to cover and extinguish burning white phosphorus particles on the skin. Fluorescein sodium is used for diagnosis of lesions of the cornea, the transparent outer layer of the eyeball. Sulfacetamide sodium (par. 267) is used to treat mustard conjunctivitis and infected mustard burns of the eye. See paragraph 265 for uses of tetracaine ophthalmic ointment. Eye and nose drops are used for mustard conjunctivitis, nasal irritation due to mustard vapor, pain and irritation in the eye caused by arsenical blister gases, tear gases, and screening smokes. Atropine injection is used to treat nerve gas poisoning (see pars. 198–203). Atropine sulfate ointment and homatropine hydrochloride ointment (par. 280) are used to treat eye symptoms due to nerve gas.

CHAPTER 2

MEDICAL RECORDS AND REPORTS

Section I. INTRODUCTION

23. Types of Medical Records

Military medical records are divided into the following categories: (1) individual medical records, (2) health records, (3) clinical records, (4) outpatient records, and (5) administrative records and reports. This discussion is limited to description of medical records and explanation of their uses and purposes. Complete information on the preparation, uses, and preservation of medical records is contained in Army Regulations.

24. Importance of Medical Records

The great value of medical records to the Army, Army Medical Service, and the individual soldier is evident in the purposes they serve. Some important purposes of medical records are the following:

a. To provide complete, up-to-date medical information on every individual in the Army.

b. To provide essential data about the use and retention of military personnel.

c. To facilitate the appraisal of fitness for duty.

d. To identify dead persons when other means of identification are not adequate.

e. To provide protection for both the individual and the Government in the settlement of claims for compensations or pensions. Medical records protect the individual soldier by serving as an official record of any illness, injury, or wound he incurs during military service—a record which can be used later as evidence on which to base a claim for a pension or other benefits from the Government.

f. To provide a means for collection of data and compilation of statistics that form the basis of recurrent reports which are used for—

(1) Studies of the incidence (extent of occurrence), nature, and aftermath of diseases, injuries, and wounds.

(2) Evaluating the effectiveness of measures used to prevent diseases and to control epidemics.

(3) Research leading to the development of improved medical, diagnostic, and surgical techniques.

(4) Future planning by higher levels of command.

g. To secure important intelligence data, particularly during periods of combat. Entries on medical records can reveal such information as the type of missile the enemy is using, where and how the enemy is using it, and the chemical or biological agents the enemy is using.

25. Responsibility of the Medical Specialist

The medical specialist works in one way or another with medical records wherever he is assigned. Thus, he needs to know the various types of medical records and when and why each record is used. The maintenance of adequate medical records is a responsibility shared to some extent by all personnel of the Army Medical Service. The medical specialist's role in the preparation of the records will vary with the type and size of the medical treatment facility to which he is assigned. When the medical specialist actually prepares a medical record, a medical service officer is responsible for the completeness of the record, but the medical specialist is responsible to the officer for the accuracy of all entries he makes. The medical specialist is not expected to make entries of a professional nature, but there may be times when he will transfer such entries from work sheets to the final copy of a record.

26. Terms Used in Medical Records

The preparation of Army medical records requires the use of certain specialized terms, some of which are defined below.

a. Classification of Patients. Patients are classified either as outpatients or as inpatients.

b. Outpatient. When applied to active duty military personnel, the term "outpatient" means a patient who is treated on a duty status or who is not excused from duty for more than 1 calendar day. Applied to other personnel, the term refers to a patient treated on an ambulatory basis.

c. Inpatient. The term "inpatient" is used for active duty military personnel excused from duty for treatment and for all other personnel admitted to a medical treatment facility.

d. Excused from Duty. This term is applied to an individual who is relieved from performing military duties for a period of time beyond midnight of the day he reports for treatment. He may be excused from duty for treatment in quarters or in a hospital.

e. Admission. For military personnel, the term "admission" refers to the act of placing an individual under treatment or observation in a hospital or a dispensary, or in quarters on an excused from duty status without return to duty by midnight on the day of admission. For nonmilitary patients, this term refers to the entrance

of an individual into a hospital for treatment or observation as a bed patient. This term is not used for outpatients.

f. Direct Admission. The term refers only to the admission to the first medical treatment facility for the current episode of disease or injury. The term "direct-casual admission" is used for an individual admitted direct to a medical treatment facility which is not charged with providing primary medical care to the individual's unit.

g. Admission by Transfer. This term is used to show that the patient admitted is one who has already been recorded as a direct admission by some other military medical treatment facility for the current uninterrupted episode of disease or injury.

h. Carded for Record Only (CRO). This term is used for a case in which an individual medical record has to be prepared in the same way as for an admission, even though an admission has not occurred. The kinds of cases required to be carded for record only are described in AR 40–400.

i. Disposition. This term refers to the removal of a patient from the rolls of a medical treatment facility by return to duty, transfer to another medical treatment facility, discharge from a hospital, death, separation from the service, or expiration of 10 days' AWOL.

j. Completed Case. The term is used for a patient for whom disposition has been made in any manner other than transfer to another military medical treatment facility.

k. Wounded or Injured in Action (WIA). This term is applied to personnel who are wounded or injured in combat or while going to or returning from a combat mission.

l. Killed in Action (KIA). This means personnel who are killed outright or who die of wounds or injuries received in combat *before* reaching an aid station or other medical treatment facility.

m. Died of Wounds or Injuries Received in Action (DOW). This refers to personnel who die from wounds or injuries, received in action, *after* reaching an aid station or other medical treatment facility.

n. Line of Duty. In the individual medical record, an injury, wound, or disease is described as to line of duty status. An entry has to be made to show whether or not the condition was incurred in line of duty. This entry gives the Army data for administering death gratuities, disability benefits, and loss of time and pay. Determination of line of duty status is not the responsibility of the medical specialist.

Section II. INDIVIDUAL MEDICAL RECORDS

27. General

a. The individual medical records are the Emergency Medical Tag (original copy), the Field Medical Card, and the Clinical

Record Cover Sheet (first carbon copy). AR 40–400 covers preparation and disposition of these records.

b. Every medical treatment facility is required to prepare an individual medical record for each patient admitted and for each case carded for record only. However, a medical treatment facility uses only one of the three forms as its individual medical record. The type of form used depends upon the level of the treatment facility and the conditions under which it is operating.

28. Entries in Individual Medical Records

AR 40–400 contains instructions for making entries on individual medical records.

a. Technical Terminology. Every disease or injury should be recorded in approved diagnostic nomenclature using the terminology in SR 40–1025–1 (medical) and SR 40–1025–2 (psychiatric).

b. Abbreviations Authorized. Authorized abbreviations (AR 320–50) may be used in any individual medical record. In addition, certain specific abbreviations are prescribed (AR 40–400) for use in the clinical record cover sheet and the emergency medical tag.

c. Recording of Anatomical Locations.

(1) When a diagnosis, other descriptive condition, or description of a surgical procedure is entered on an individual medical record, enough anatomical data must be recorded to provide adequate medical and surgical representation of it. AR 40–423 contains instructions for recording anatomical locations.

(2) Anatomical terminology used should be that contained in the Standard Nomenclature of Diseases and Operations. These terms should be supplemented by appropriate qualifying words, such as "right," "left," "bilateral," "anterior," or "posterior."

(3) In recording punctured, penetrating, perforating, or missile wounds, state the point or region of entry, with other necessary anatomical detail, such as involvement of organs, arteries, or nerves.

29. Emergency Medical Tag (EMT)

a. General. The Emergency Medical Tag (DA Form 8–26) is the individual medical record used by aid stations and clearing stations and by nonfixed dispensaries operating overseas, on maneuvers, or attached to commands moving between stations. The emergency medical tag is designed for use in forward combat areas where the keeping of detailed clinical records is impractical. The main purpose of the emergency medical tag is to furnish medical officers, who see the casualty during evacuation, with essential in-

formation about the casualty's injury or disease and the treatment given him.

b. Description. The emergency medical tag is made so that it can be attached to a casualty. The tags are issued as a pad, each containing 20 complete sets. A set consists of an original tag, a sheet of carbon paper, a carbon protective sheet, and a duplicate tag. The front side of the tag has spaces for the casualty's name, serial number, diagnosis, treatment, and other essential information. On the reverse side of tag, or Supplemental Record, additional entries can be made as needed.

c. Preparation. In the aid station or other medical treatment facility using it, the emergency medical tag is prepared in duplicate for each case admitted direct and for each case carded for record only. The tag is completed by, or under supervision of, a medical service officer of the medical treatment facility involved, except in certain killed-in-action cases. For a person killed in action, the emergency medical tag is prepared by the first authorized member of the medical service, either officer or enlisted, who finds or examines the body. In combat, medical aid men attending casualties in the field may initiate the tag by recording enough entries to identify the individual and to describe briefly the medical treatment given him. The aid man will place his initials in the extreme right portion of the space provided for signature. Each emergency medical tag should be reviewed, completed, and signed by a medical service officer (or his enlisted designee). The tag initiated on admission (by an aid man or personnel of the medical treatment facility) should be tied to the patient's clothing, and left there while the patient is being transferred between Army medical treatment facilities which use the EMT as the individual medical record. The medical treatment facilities through which the patient passes make their entries on the "Supplemental Record," the reverse side of the tag (par. 30*i*). If additional space is needed, another EMT, labeled "EMT No. 2" and containing identifying information, should be attached to the original and the supplemental record of the second tag used.

30. Entries on Emergency Medical Tag

AR 40–400 contains instructions for preparation of the emergency medical tag.

a. General Rules. All information entered on the EMT should be accurate, clear, and brief. In combat or other situations where security requires it, some entries may be omitted by aid stations. The minimal entries in these situations are the patient's name, service number, grade, date, and hour tagged, diagnosis, line of duty, treatment, disposition, and signature and grade of responsible medical service officer or his enlisted designee. Medical treatment facili-

ties using the EMT outside combat should complete all entries. Instructions for specific entries are given below.

b. Name and Serial Number. Record these entries in the first space atop the front of the tag. Record the patient's last name, first name, and middle initial, followed by his serial number. This information can be obtained from either the patient, his identification tags, or personal records.

c. Grade. The grade should be entered the first time an EMT is prepared.

d. Date and Hour Tagged. In these spaces, record the date and the hour, expressed in the 2400–hour system, when the patient first received any type of medical care by any member of the medical service.

e. Diagnosis. This entry must be made in every case. Use authorized abbreviations to record the diagnosis. Describe the injury, wound or disease, and tell how, when, and where it was incurred. Put in additional information for wounds or injuries incurred in combat. Specify whether the wound or injury (or death) was incurred as the direct result of enemy action. In these cases, one of the abbreviations WIA, DOW, or KIA, as applicable, should be entered before the diagnosis. Also, for a casualty wounded in action or killed in action, record the type of wounding agent.

f. Treatment. Every important fact about the treatment given the casualty should be written on the tag. Record every dose of morphine, penicillin, or other drugs the casualty has been given. Also record transfusions of whole blood or of plasma volume expander. Also record the time of treatment. When a tourniquet has been applied, this fact and time of application should be written on the tag. If temperature, pulse, or respiration is taken, this fact should be recorded. Application of a dressing or a splint should also be shown by notation on the tag.

g. Disposition. The date on which the patient is returned to duty, transferred, or dies is the date of disposition. The date is recorded in days, month, and year.

h. Signature. The tag is signed by the commanding officer of the medical treatment facility or by his authorized representative. The enlisted man who prepares the tag should write his initials upon the tag at the extreme right side of the signature space.

i. Supplemental Record. The reverse side of the tag is the supplemental record. It is used to enter information about additional treatment given the patient or about changes in his condition noted while he is being evacuated.

31. Disposition of Emergency Medical Tag

a. Completed Cases. If the patient is returned to duty, or carded for record only, the original copy of the EMT is kept by the medical

treatment facility making disposition of the case. Later the facility sends this copy to The Surgeon General. The tag never should go with the patient to his organization. For patients who are killed in action or who die in, or on the way to, a medical treatment facility, the original EMT is left attached to the body until it reaches the place of burial. Then the tag is removed for transmittal to The Surgeon General.

b. Transferred Cases. When a patient is transferred from one medical treatment facility to another farther to the rear, the tag goes with the patient. It remains attached to him until he reaches a hospital, dies and is buried, or is returned to duty.

c. Carbon Copies. In oversea commands, carbon copies of emergency medical tags are used as the theater surgeon prescribes. In the United States, the senior medical officer of organizations engaged in troop movements or maneuvers prescribes the use of carbon copies of the tags.

32. Field Medical Card

a. Description and Use. The Field Medical Card (DA Form 8–27) is an individual medical record used by hospitals operating in forward combat areas. When authorized by the theater commander, hospitals may use this form, instead of the clinical record cover sheet, for recording patients excused from duty or patients carded for record only. The field medical card is a folding form consisting of a series of sections. This makes it easy to prepare a consecutive medical record on a patient transferred between hospitals in the evacuation system. Spaces for entering the patient's name and other personal data are provided in the first section of the card. The other sections have spaces for entering the name and location of the receiving hospital, date of admission, diagnosis and operations, disposition and date of disposition. Usually, each hospital uses a separate section. However, a hospital can use more than one section if it needs the space. Regardless of how a section is used, the responsible officer of the using hospital signs the section. The field medical card is used as long as the patient is being transferred between hospitals authorized to use this form as their individual medical record.

b. Disposition. When the field medical card is the last individual medical record used for a completed case, it is forwarded to The Surgeon General. When a patient is transferred to a medical treatment facility which uses the clinical record cover sheet as the individual medical record, the receiving facility closes out the field medical card as AR 40–400 prescribes.

33. Field Medical Record Jacket

The Field Medical Record Jacket (DA Form 8–28) is not an individual medical record, although for convenience it bears certain information about a patient. It serves as envelope for carrying medical records of an individual and as a record of transportation data. It is used when patients are transferred from medical treatment facilities authorized to use either the field medical card or the clinical record cover sheet. When final disposition is made in a case where the field medical record jacket is used, the jacket is sent to The Surgeon General with the individual medical records of the patient.

34. Clinical Record Cover Sheet

a. Use. The Clinical Record Cover Sheet (DD Form 481–3) is the most widely used individual medical record. It is used by all hospitals, fixed dispensaries, neuropsychiatric treatment stations, and convalescent centers. In oversea commands, it may be used by clearing stations operating as nonfixed hospitals and by holding stations.

b. Purpose. In addition to serving as an individual medical record, the clinical record cover sheet is an essential part of every clinical record (pars. 36–39). It is also an essential document in the health record (pars. 40–43).

c. Preparation. Since AR 40–400 contains full instructions for use of the clinical record cover sheet, this discussion is limited to a few important points about the form's preparation and disposition. For military personnel, the clinical record cover sheet is prepared in four copies. The original is used as the summary filed as the first sheet of the clinical record. One carbon copy is included with the individual medical records sent monthly to The Surgeon General. Another carbon copy is included in the patient's health record file, and the third carbon copy is kept by the medical treatment facility. For nonmilitary personnel, the cover sheet is usually prepared in three copies as there is no need for a health record copy. Otherwise the distribution of copies is the same as for military patients, except when followup care is necessary. Then the cover sheet is prepared in four copies, so that a carbon copy can be put in the outpatient record. Upon disposition of the case, the clinical record cover sheet is completed, reviewed, and all copies signed by the officer responsible for the medical records of the facility.

35. Transmittal of Records to The Surgeon General

Each month every separate functioning medical treatment facility is required (AR 40–400) to send to The Surgeon General the individual medical records of all completed cases, or to advise The Surgeon General if no cases have been completed. The records are

sent with a letter telling the period of time when the cases were completed, the total number of records inclosed, and separately the number of records for Army active duty personnel, Navy or Marine active duty personnel, Air Force active duty personnel, dependents of active duty personnel, and other personnel. The records which are to be forwarded each month to The Surgeon General are all first copies of clinical record cover sheets, original copies of emergency medical tags, and field medical cards of completed cases. Medical treatment facilities in the United States transmit individual medical records direct to The Surgeon General. Medical treatment facilities outside the United States send records through medical channels, as directed by the command surgeon, to The Surgeon General.

Section III. HEALTH RECORD

36. General

a. Description. The health record is a permanent, locally available file of records prepared for an individual as he received medical and dental care. Each contact a person has—as a patient—with medical service during his military career is recorded in his health record. The health record is divided into two sections: (1) the health record jacket, (DD Form 722); and (2) the health record dental folder (DD Form 722–1).

b. Purpose. The main purpose of the health record is to insure that information on the medical care of an individual is immediately accessible to medical service personnel except during active combat.

37. Maintenance of Health Record

a. Health records are maintained (AR 40–403) for all Army personnel on active duty or on active duty for training for more than 30 days and for cadets of the United States Military Academy.

b. An individual's health record is initiated when he enters military service and his first physical examination is recorded, previous medical history reported, and initial immunizations given. Throughout his military career, each medical or dental treatment or examination is recorded in his health record. Inpatient care (quarters or hospital) is shown in the health record by a copy of the clinical record cover sheet and a copy of the narrative summary. In combat, a copy of the emergency medical tag or field medical card may be used instead of the clinical record cover sheet. Outpatient care is shown in health record by the Chronological Record of Medical Care.

c. When an individual is at his station, his health record is filed and maintained in the dispensary, or other medical treatment facility, where he receives primary medical care, and in the dental clinic furnishing his dental service.

d. When an individual is hospitalized, his health record is made available to the hospital.

e. In combat areas the health record is filed with the personnel records.

f. When an individual has a change of station, his health record is forwarded with personnel records.

38. Contents of Health Record Jacket

a. Abstract of Service, Health Record (DD Form 735).

b. Chronological Record of Medical Care (SF 600).

c. Immunization Record (SF 601).

d. Report of Medical Examination (SF 88).

e. Report of Medical History (SF 89).

f. Other documents of medical significance as described in AR 40–403.

39. Chronological Record of Medical Care

The Chronological Record of Medical Care is one of the most important forms in the health record. Each event involving medical care in a person's military health history is recorded on it.

a. This form is the basic outpatient medical record for all military personnel on whom health records are kept (par. 37). Outpatient medical records required for other personnel are discussed in paragraph 42. Every appearance of military personnel for outpatient care at a dispensary or other medical treatment facility should be recorded on this form. Use of the form in a dispensary, especially during sick call, is discussed in paragraph 288.

b. In addition, this form is used to record a person's admission to hospital or quarters, except under combat conditions.

c. Entries should be made at the time the patient is seen. Ordinarily, entries in the Chronological Record of Medical Care are made by writing in ink, but they may be typewritten. An entry should include a concise description of symptoms, diagnosis, and treatment given. It should also include the name of treating organization. Each entry should be dated and signed by the physician or other person who attends the patient or makes the entry.

Section IV. CLINICAL RECORDS AND OUTPATIENT MEDICAL RECORDS

40. Clinical Record

a. A clinical record is a file maintained by hospitals and other medical treatment facilities for each patient admitted. A clinical record includes the clinical record cover sheet and the forms on which are recorded the medical history of a patient during one current continuous episode of a disease, an injury, or other condition. AR 40–424 lists the various forms that are filed in clinical records.

b. Clinical records are prepared for all patients, military or civilian, admitted to a medical treatment facility and for all military personnel excused from duty for treatment in quarters. Exceptions to the requirement for clinical records may be authorized in combat areas where their use is not practical or where medical treatment facilities use the emergency medical tag or field medical card.

41. Preparation of Clinical Records

a. AR 40–424 contain detailed instructions for preparing and maintaining clinical records. Information entered in clinical records should be typewritten or written in permanent black or blue-black ink. Entries should be dated and signed by the person who makes them.

b. Ordinarily, a patient's clinical record begins with the preparation of a clinical record cover sheet when he is admitted to a hospital. If a patient is admitted by transfer, the forms received with the patient are attached to the clinical record cover sheet. Then the clinical record is sent with the patient to his ward where it is furnished to the ward officer, who prepares or supervises preparation of additional forms which become part of the clinical record. The clinical record remains in custody of the ward medical officer while the patient is under his care, being furnished as needed to chiefs of services, consultants, and other authorized personnel. If a patient is transferred to another ward, his clinical record also is transferred.

c. While a clinical record file is maintained on the ward, forms in it are arranged in the order prescribed by the medical treatment facility. The forms should be arranged in the following order before the clinical record leaves the ward: the clinical record cover sheet covering other forms; standard forms, Department of Defense forms, and Department of Army forms, with each group in numerical sequence. When the ward officer is satisfied that the clinical record is complete, he forwards it through the appropriate chief of service to the hospital registrar for final disposition.

42. Outpatient Medical Record

The Outpatient Medical Record (DA Form 8–255) is the form used for recording outpatient care given to military dependents, retired military personnel, Veterans Administration beneficiaries, or others for whom health records are not kept.

a. *Purpose.* This record serves several purposes. It provides medical officers with a current continuous account of an individual's treatment. If the individual is admitted to a hospital, his outpatient record may be made available to his ward officer. This record is also useful in preparing individual medical records carded for record only and covering injuries or diseases which sometimes result in claims for disability compensation or pension.

b. Preparation. An outpatient medical record is prepared as prescribed in AR 40–425. Additional instructions are printed on the face of the form. Entries are required for the outpatient's name, sex, age or date of birth, designation and address of the medical treatment facility, symptoms, diagnosis, treatment, and summaries of consultation reports. Also to be included is a brief description of the outpatient's status, such as "VA beneficiary," or "permanently retired Army sergeant." For dependents of a member of the Armed Forces, the form should show the name, grade, service number, and department of that member and the outpatient's relationship to him.

43. Individual Sick Slip

The Individual Sick Slip (DD Form 689) is an informal memorandum about a person who has requested or received medical attention.

a. Purpose. The individual sick slip is used primarily to exchange information between the patient's unit commander and the medical officer concerned. It is the basis for entries in the Morning Report of the patient's unit and, when required, for initiation of action by the unit commander to establish line of duty status of the patient. The sick slip is not considered to be a record, because normally it is destroyed after serving its primary purpose. An exception to this procedure is made when the sick slip is needed by an officer exercising special court-martial jurisdiction for determination of line of duty status.

b. Preparation. Usually, a unit prepares a sick slip for each member who reports to sick call. The sick slip accompanies the individual to the medical treatment facility. In exceptional cases, the treatment facility initiates the sick slip. Examples of these cases are when an individual is authorized to report directly to the treatment facility or when there is an emergency. The sick slip consists of three parts: the identification section, the unit commander's section, and the medical officer's section.

(1) *Identification section.* The date, patient's name, service number, grade, organization, and station are entered in this section, which is filled in when the sick slip is initiated.

(2) *Unit commander's section.* This section calls for line of duty status, remarks, and signature of the unit commander. This section is not prepared if the line of duty determination is "yes" or "no (EPTS)." The latter term is an abbreviation meaning "existed prior to service entry."

(3) *Medical officer's section.* The examining medical officer makes the entries in this section as required by AR 40–207.

c. Disposition. Ordinarily, the medical treatment facility returns a patient's sick slip to his unit commander as soon as possible after

completion of the medical officer's section. When an individual reports directly to the treatment facility, the sick slip need not be returned to the unit commander if no change in duty status is involved or if some other method of notification is used.

Section V. STANDARD MEDICAL REPORTS

44. General

The Department of Defense prescribes three standard reports for use in the Army and other military medical services. They are the Morbidity Report, Beds and Patient Report, and Outpatient Report. The reports are closely related to each other and to individual medical records. All three reports are prepared and submitted monthly as prescribed in Army Regulations.

45. Morbidity Report

a. The Morbidity Report (DD Form 442) is prepared by each separate functioning Army medical treatment facility in the United States and overseas. AR 40–417 contains instructions for its preparation.

b. In this report, the medical treatment facility accounts for all military patients treated on an excused-from-duty status, for all nonmilitary personnel admitted for medical care or observation, and for individuals carded for record only. The report includes distribution of these cases by diagnostic class and selected diagnosis. It also gives the average number of persons provided primary, or dispensary type, medical care by the reporting facility.

c. The information contained in this report aids in analyzing the health of the Armed Forces, indicates disease trends, and aids in mobilizing preventive medicine measures.

46. Beds and Patients Report

a. The Beds and Patients Report (DD Form 443) is prepared by each functioning Army hospital in the United States and overseas. AR 40–418 contains instructions for its preparation.

b. In this report, a hospital tells the number of patients admitted, disposition of patients, number of beds occupied, and bed capacity. These data serve as one basis for evaluating personnel requirements and use of hospitals, for preparing budget estimates, and for determining future requirements.

47. Outpatient Report

a. The Outpatient Report (DD Form 444) is prepared by each separate functioning Army medical treatment. AR 40–419 contains instructions for its preparation.

b. In this report, a treatment facility gives data on medical care furnished to outpatients. Included are data on outpatient visits and treatments, on the various types of physical examinations and immunizations, and on certain diagnostic and treatment procedures. This information is useful in the preparation of budget estimates, in the analysis of personnel requirements and use, and in evaluation of morbidity (sickness) levels.

CHAPTER 3

ANATOMY AND PHYSIOLOGY

Section I. INTRODUCTION

48. Study of the Body

The human body consists of various types of tissues and organs supported by a bony framework and organized so that they work together for the benefit of the body as a whole.

a. Anatomy. Anatomy is the study of the structure of the human body and the relations of its parts. Anatomy consists of a number of studies such as the study of bones, the study of joints, the study of muscles, the study of the blood vascular system, the study of the nervous system and special senses, the study of the internal organs, the study of the ductless glands, and the study of the skin.

b. Physiology. Physiology is the study of the normal functions and activities of the structure or mechanisms of the body.

c. Pathology. Pathology is the study of changes in the structure or function of the body caused by disease or trauma.

49. Terms of Position and Direction

The normal anatomical position of the body, for descriptive purposes, is the erect position with the arms hanging by the side and the palms of the hands facing forward.

a. Location. The following terms are used in referring to location:

(1) *Anterior.* At or near the front side of the body.
(2) *Posterior.* At or near the back side of the body.
(3) *Medial.* Toward the midline of the body.
(4) *Lateral.* To the left or to the right of the midline.
(5) *Internal.* Inside or deep within the body.
(6) *External.* Outside or superficial.
(7) *Dorsal.* The back side of the body.
(8) *Ventral.* The belly side of the body.
(9) *Proximal.* Nearest the point of origin or attachment. Used most in describing the limbs.
(10) *Peripheral.* At or toward the surface of the body.
(11) *Distal.* Away from the point of origin or attachment.
(12) *Superior.* Toward the head.
(13) *Inferior.* Toward the feet.

b. Anatomical Postures. The anatomical postures are as follows:

(1) *Erect.* The normal posture of the body in a standing position.

(2) *Supine.* The horizontal position of the body lying flat on the back.

(3) *Prone.* The horizontal position of the body lying face down.

(4) *Laterally recumbent.* The horizontal position of the body lying on either the right or left side.

c. Surface Anatomy. The surface anatomy of the human body is shown in figure 1 (ventral or belly side) and figure 2 (dorsal or back side). Surgical areas of the abdomen are shown in figure 3.

d. Anatomical Planes. Certain planes through the body are commonly used to identify structures and areas as follows:

(1) *Median (or midsagittal).* An imaginary plane passing from the front to the back through the center of the body, dividing the body into right and left equal portions.

(2) *Sagittal.* An imaginery plane parallel to the median plane dividing the body into right and left unequal parts.

50. Basic Medical Terms

See appendix II for definitions of other common medical terms, for construction of medical terms, and for common prefixes, suffixes, and stems used to form medical terms.

51. Classification of Living Matter

a. All things that exist in nature are classified into three general groups: *animal*, *vegetable*, and *mineral*. The animal and vegetable groups are living, while the mineral group is not living. An *organism* is a living thing whether it is vegetable or animal. The difference between plant and animal life is in their respective life processes. Plants can produce their own food by the action of sunlight on the tissues of the plant. By this process materials brought up from the roots of the plants are combined with carbon dioxide from the atmosphere to form starch. Animals lack this ability and must eat food to live. All animal food energy is derived from plants or other animals.

b. Animals are classified according to their structure. *Invertebrates* have no backbone. Sponges, worms, shellfish, and insects are included among the invertebrates. *Vertebrates* have a backbone. Fish, birds, reptiles, and mammals are vertebrates. Mammals such as mice, dogs, elephants, and man are vertebrates which nurse their young.

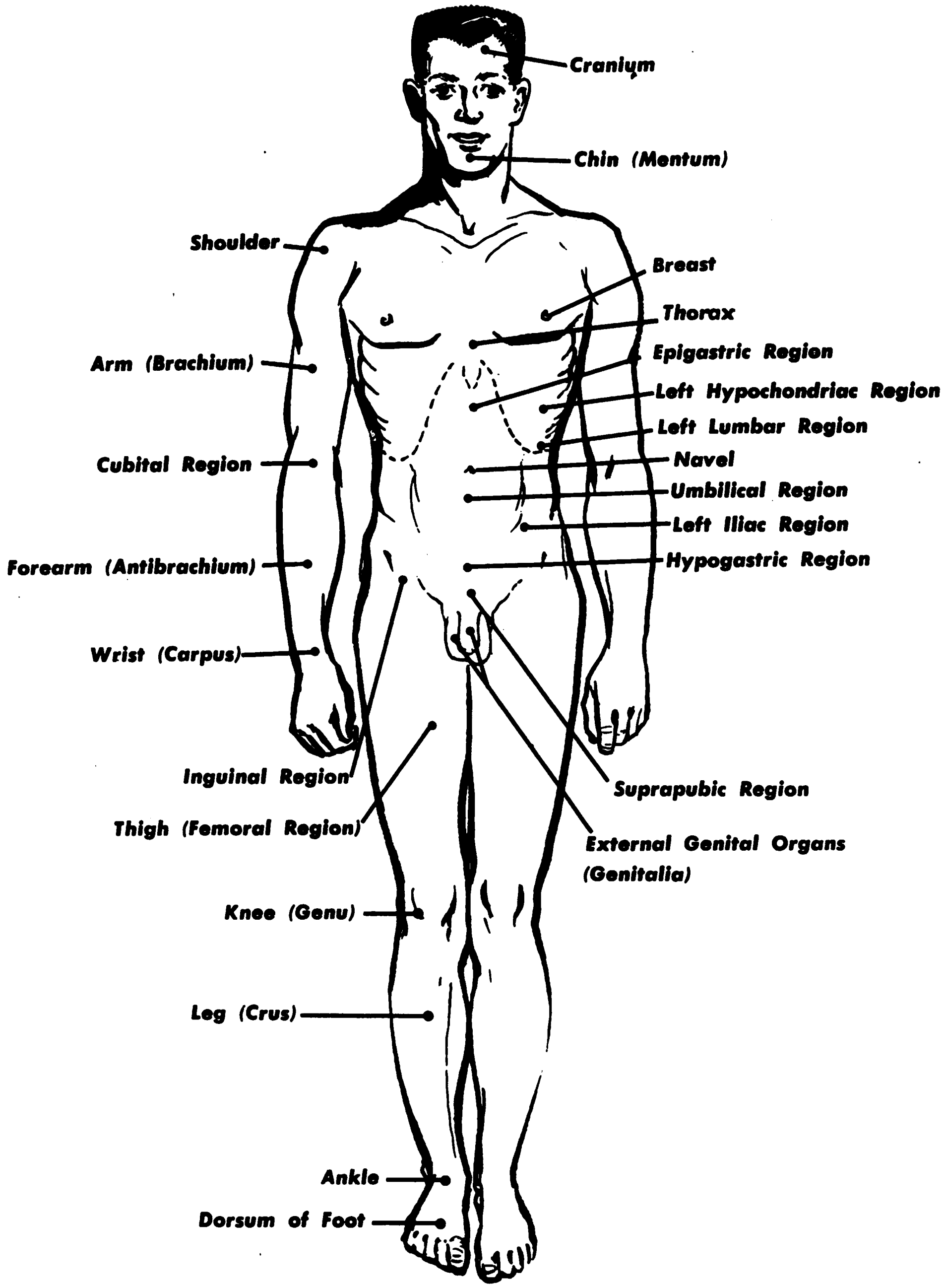


Figure 1. Names of body regions, ventral view.

52. Characteristics of Living Matter

Certain properties of living matter set it apart from lifeless things in nature. These characteristics are *physiologic processes* essential to life. They are found in all living matter from single cells up to the highest forms of animal and plant life. *Metabolism*, the first essential characteristic, is the sum of many biochemical processes. It includes the assimilation, storage, and use of food for the growth and repair of body tissues; the combination of foods with oxygen

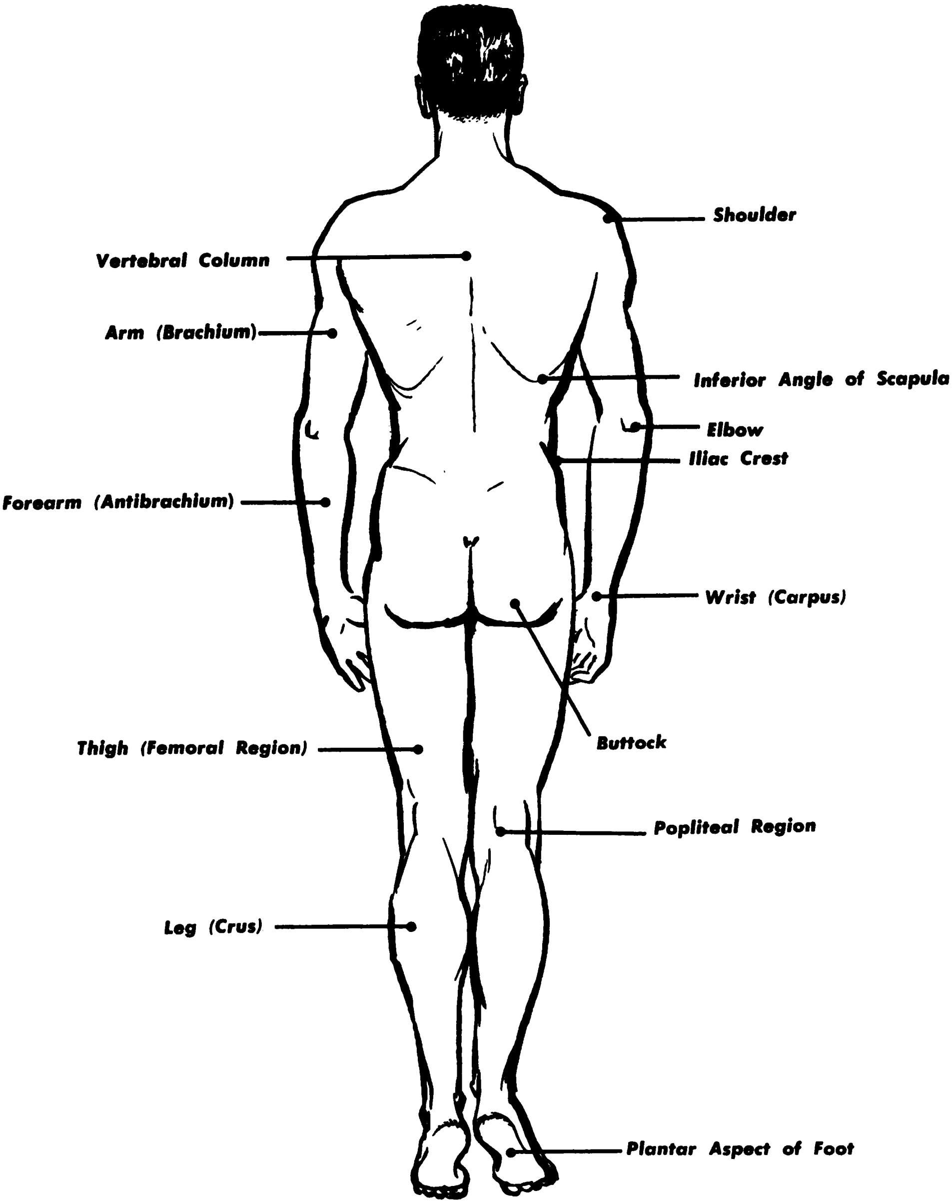


Figure 2. Names of body regions, dorsal view.

to release energy; and the excretion of wastes. *Irritability* is another characteristic of living matter. This is the ability to respond to a stimulus (change in environment). Irritablity causes the simplest one-celled animal to move away in response to the touch of a sharp, pointed instrument. Likewise, it causes the human being to respond to changes in his environment, such as light, sound, warmth, cold, and mechanical impact. Groups of cells are specialized to respond characteristically to specific stimuli. For instance, nerve cells are specialized for conductivity. This is the ability to conduct an impulse from the place of stimulation to other parts of the organism. Muscle cells have the special property known as *contractility*. Thus, when they are stimulated, muscle cells contract to produce movement.

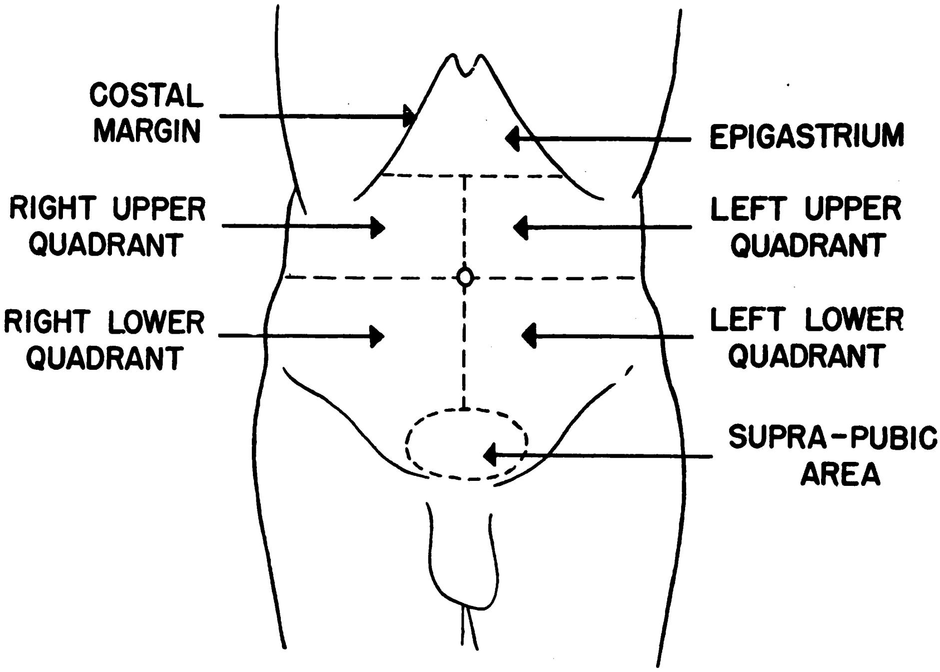


Figure 3. Surgical areas of the abdomen.

Living matter has other important properties which nonliving material does not have. It has the power of *reproduction.* This is the ability to form new individuals of the next generation, thus keeping life going from one generation to the next. Living matter also has *organization.* The parts of a living organism are not thrown together haphazardly. Instead, they are arranged in a definite pattern so that their particular functions are coordinated for the benefit of the organism as a whole. When all these vital functions cease, when metabolism stops, the organism is said to be dead.

53. Cells

The cell is the smallest unit of living matter. Cells are the anatomical and physiological units of the body. Cells make up all living matter. Some animals, such as the *ameba,* consist of one cell. In other animals the number of cells may be countless. Whatever the number of cells may be, each cell can carry on the functions essential to life. Cells are composed of a substance called *protoplasm.* It gives living matter the properties described in paragraph 52. A typical cell (fig. 4) is made of a cell wall and two main parts, the *nucleus* and the *cytoplasm.* The cell membrane encloses the protoplasm and permits the passage of food into and wastes out of the cell. This is important because all body cells are bathed in tissue fluid from which they get the food essential for life and growth. The nucleus is the "headquarters" of the cell and controls all activities of the cell, including growth and reproduction. Cytoplasm is the substance surrounding the nucleus and is responsible for most of

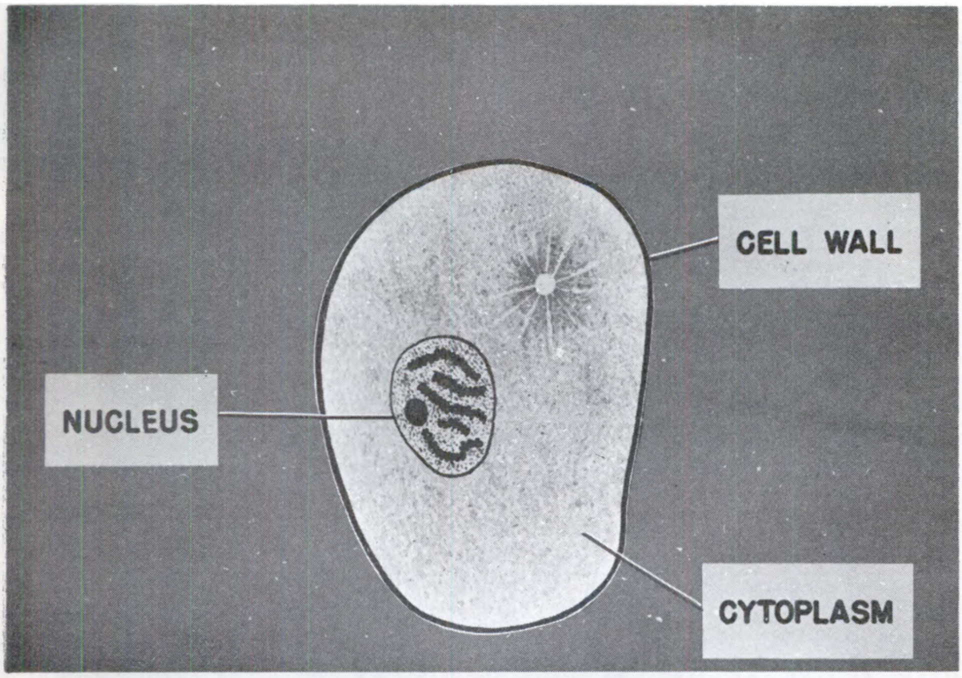


Figure 4. Simple cell.

the work done by the cell. Cells reproduce by division. The purpose of their reproduction is to replace worn-out cells, to build new tissues, and to bring about the growth of the body as a whole. Cells are bound together into tissues by a cementing substance which they produce.

54. Tissue

A tissue is a group of similar cells. For example, liver cells are bound together to form liver tissue, and bone cells are bound together with lime salts to form bony tissue. The tissues of the body have different characteristics because the cells which compose them are different both in structure and function. There are four primary types of tissues in the body: *epithelial*, *connective*, *muscular*, and *nervous*.

a. Epithelial (fig. 5). This is the covering and lining tissue. As skin, epithelial tissue covers the outer surface of the body. As *mucous membrane*, it lines the nasal cavity, mouth, pharynx, larynx, trachea, stomach, and intestines. In a form called *endothelium* it lines the heart and blood vessels. As *serous membranes*, it lines the cavities of the chest and abdomen and covers the organs that lie in these cavities. Epithelial tissue also forms the *glands* of the body and parts of the *sense organs*. The functions of this tissue differ according to its location. As the skin, it protects underlying structures. In the small intestine, it secretes and absorbs. In glands, it secretes. In the kidneys and liver, it excretes. Based on the shape of the cells, there

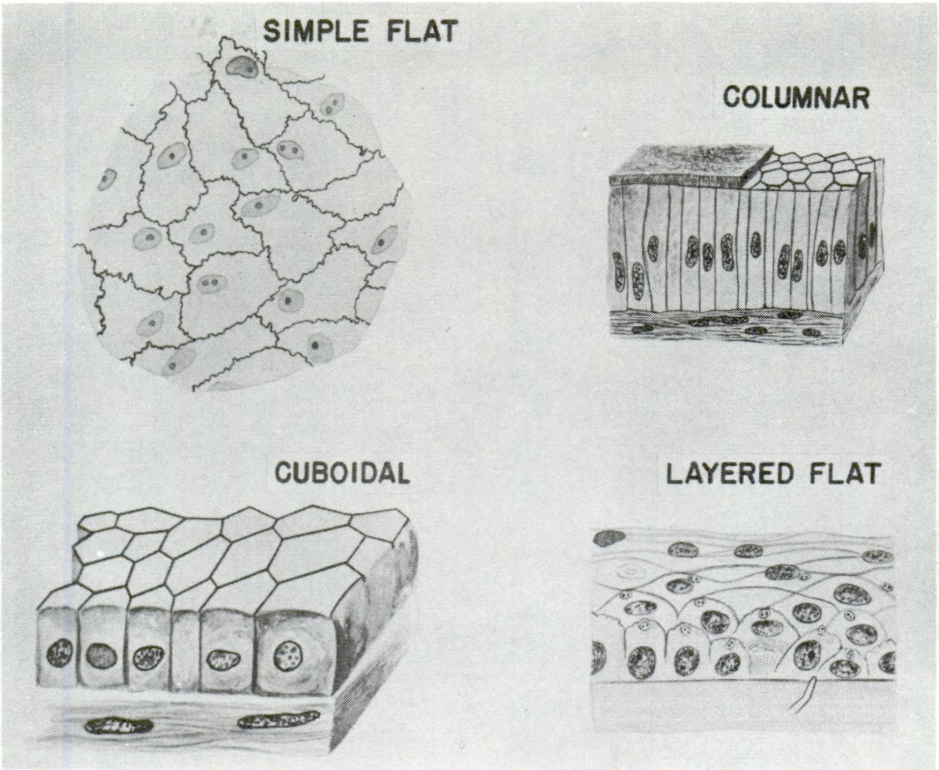


Figure 5. Epithelial tissue.

are three types of epithelial tissue. These are squamous or flat, cuboidal, and columnar. These cells are further designated as *simple*, if they are arranged in a single layer, or *stratified*, if they consist of several layers.

b. Connective (fig. 6). Connective tissue is distributed throughout the body to perform several functions. It binds together and supports other tissues. It binds organs to other organs, muscles to bones, bones to other bones. It repairs other tissues by replacing dead cells. It forms the supporting framework of the body. The main types of connective tissue are:

(1) *Areolar* tissue, which forms the subcutaneous (under the skin) layer, helps to hold the organs in place, and fills many sharp corners and small spaces of the body. It is composed of fibrous, elastic, and fatty connective tissue.

(2) *Adipose* tissue, or fat, which is found under the skin and in many regions of the body. Fat serves as a padding around and between organs. It insulates the body, reducing heat loss. Fat also serves as a food reserve in emergencies.

(3) *Reticular* tissue, which is the supporting framework of lymph glands, liver, spleen, bone marrow, and lungs.

(4) *Elastic* tissue, which is composed of elastic fibers and found in the walls of blood vessels and in the lungs.

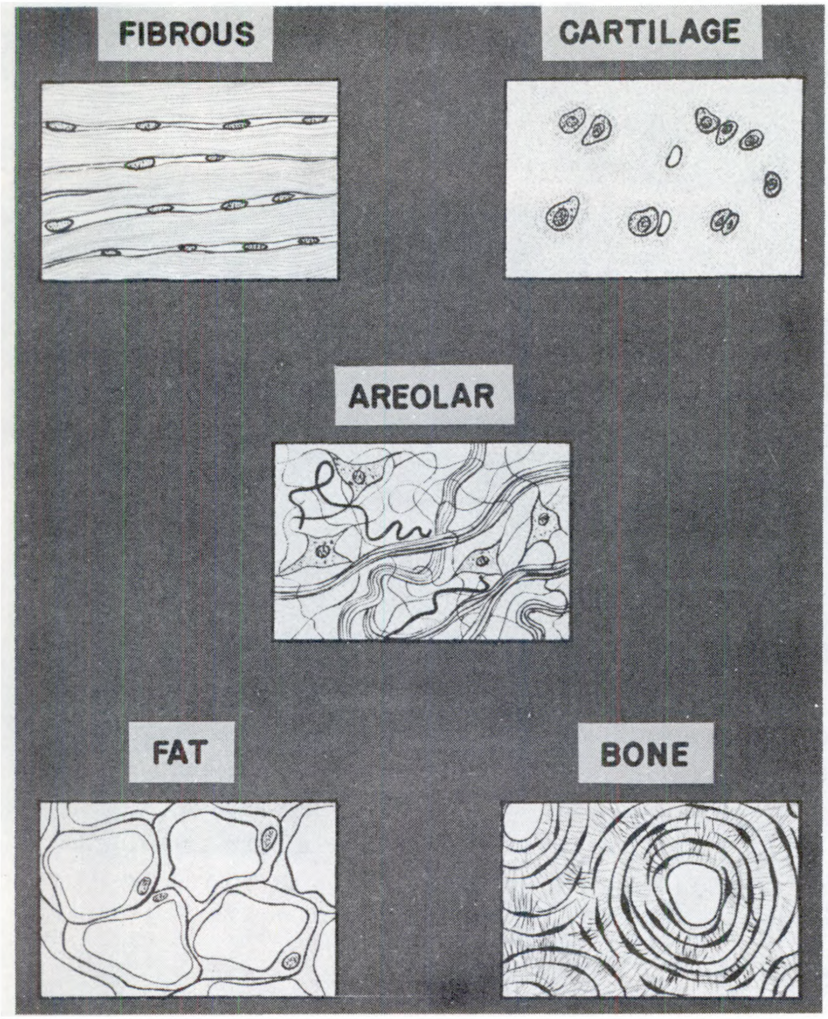


Figure 6. Connective tissue (microscopic appearance).

(5) *Cartilage*, or "gristle," which is tough, resilient tissue found at the ends of bones, between bones, and in the nose and ears. Cartilage is of three types: fibrous, elastic, and hyaline (glassy).

(6) *Osseous* tissue (bone), which is fibrous connective tissue made very hard by deposits of calcium and other mineral salts. Types of bones are discussed in paragraphs 58 and 59.

c. Muscular. This is the contracting tissue of the body. Muscular tissue is composed of long, slender cells (fibers) held together by connective tissue. The microscope shows three kinds of muscle cells (fig. 7). These are *striated*, *smooth*, and *cardiac*. See paragraphs 68 through 72, for more information about muscles.

d. Nervous. This is the conducting tissue of the body. Nervous tissue is made of nerve cells, or *neurons* (fig. 8), bound together by a special kind of tissue called "neuroglia."

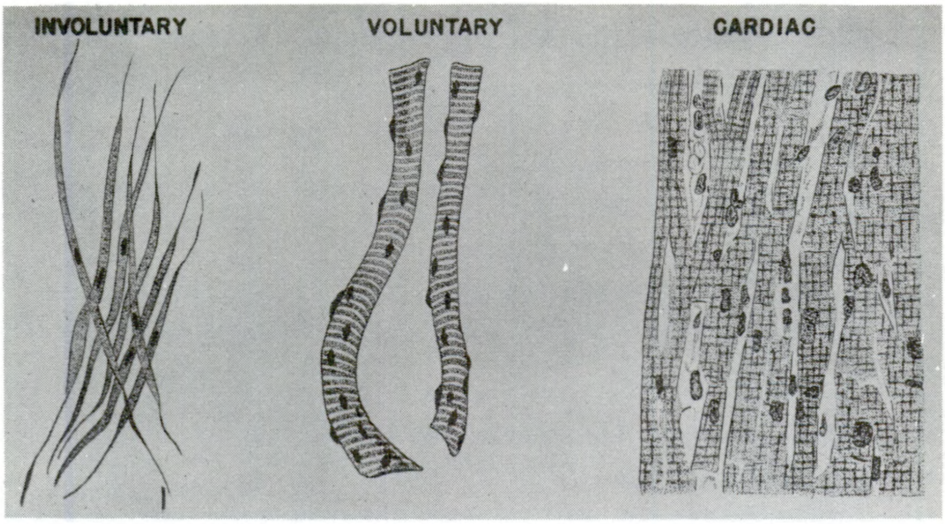


Figure 7. Kinds of muscle cells (microscopic appearance).

55. Organs

An *organ* is a group of tissues which are associated for the performance of a special function or functions. For example, the heart has the special function of pumping blood. A man may live and carry on a limited activity with only a part of certain organs. This safety factor is important when, as a result of disease or mechanical injury, a portion of an organ is destroyed or its function impaired.

56. Systems

A *system* is a combination of organs for the performance of a particular function. While each of the systems of the body performs its own distinct function, all are related and none can do its work without the cooperative activity of other systems. Thus, a condition which affects the activity of one system may affect other systems as well. The systems of the body are as follows:

a. Skeletal. Provides a framework for the body, supports and protects the organs, and furnishes a place of attachment for muscles.

b. Muscular. Moves and propels the body.

c. Nervous. Makes the entire body work together as a unit and enables the body to adjust to its environment.

d. Gastrointestinal. Receives, digests, and absorbs food substances and eliminates waste products.

e. Urogenital. The urinary portion of the system excretes wastes which leave the body in urine. The genital portion of the system produces reproductive cells and sex hormones.

f. Respiratory. Delivers oxygen from the air to the blood to supply the body tissues and removes the waste carbon dioxide.

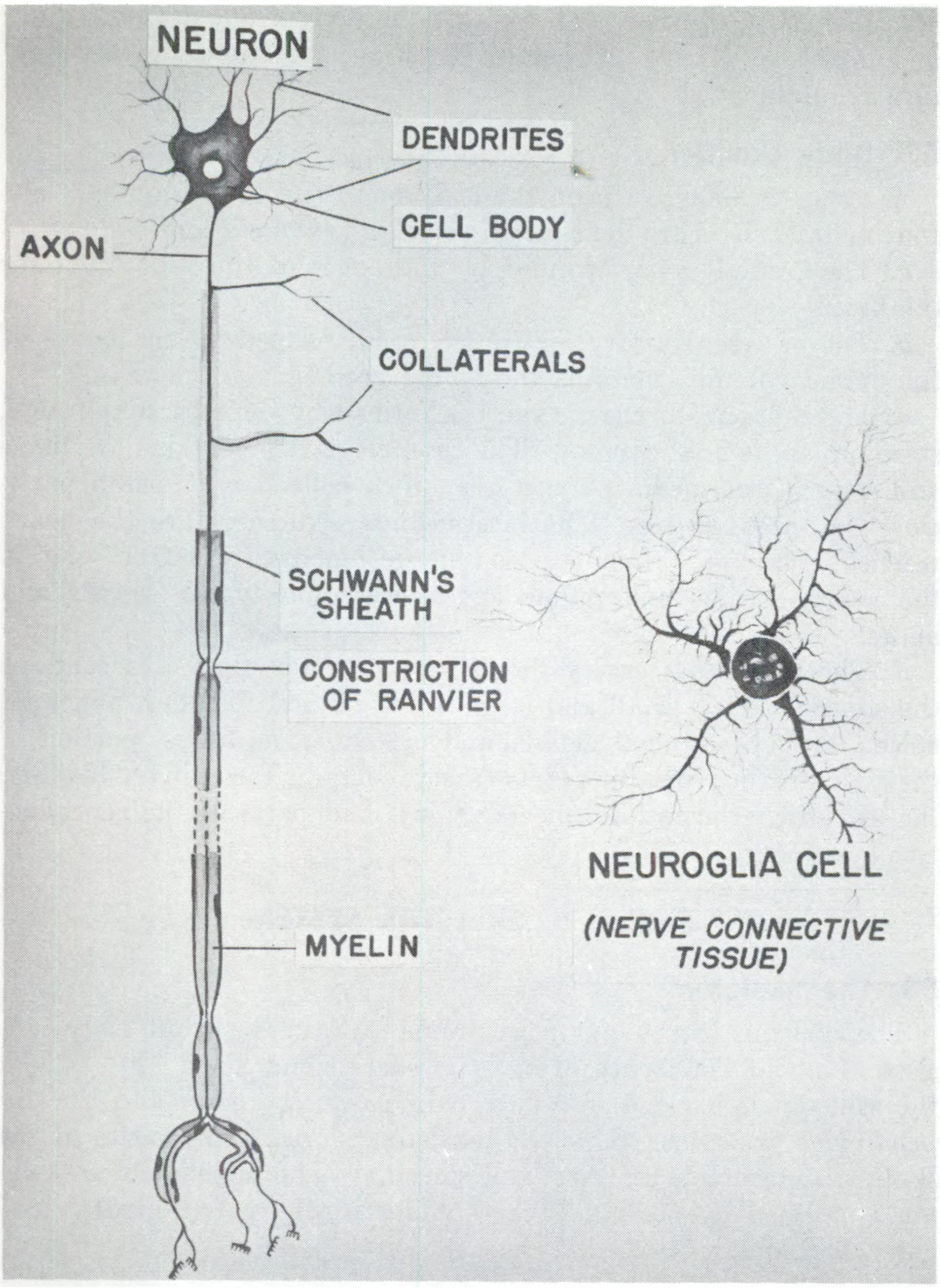


Figure 8. Neuron and neuroglia.

g. Circulatory. Circulates blood through the entire body, supplying needed materials to every living cell.

h. Lymphatic. Collects and returns to the blood fluids recovered from the tissues. The lymph nodes are important defenses against bacteria.

i. Endocrine. Controls many body activities by the manufacture of hormones which are secreted into the blood.

j. The Skin. Covers and protects the body from drying, injury and infection. Has functions of sensation, excretion, and temperature regulation.

57. Body Cavities

A cavity is a space within the body or in one of its organs. The four main cavities are the *cranial*, *vertebral*, *thoracic*, and *abdominal*.

a. The cranial cavity, formed by the bones of the skull, contains the brain.

b. The vertebral cavity, or spinal canal, formed by the bones of the spinal column, contains the spinal cord.

c. The thoracic, or chest, cavity is formed by the ribs, diaphragm, sternum, and spinal column. The thoracic cavity contains the lungs and several intermediate structures which collectively form a partition, the *mediastinum*. The intermediate structures are the heart, trachea, esophagus, thymus gland, large blood vessels from and to the heart, cardiac and pulmonary nerves, and lymph vessels and nodes.

d. The abdominal cavity lies below the diaphragm. It contains the stomach, liver, small and large intestines, gall bladder, pancreas, spleen, kidneys, adrenal glands, and ureters. The lowest portion of the abdominal cavity, the *pelvic* cavity, contains the urinary bladder, the end of the large intestine (rectum), and parts of the reproductive system.

Section II. SKELETAL SYSTEM

58. The Skeleton

The skeleton (fig. 9), or bony framework, in the adult body consists of about 206 bones of various shapes and sizes. For study, the skeleton is divided into two main parts, the *axial* and the *appendicular* skeletons. The axial skeleton is formed by bones of the skull, vertebral column, ribs, and sternum. The appendicular skeleton is formed by bones of the shoulder girdle, pelvic girdle, arm, hand, leg, and foot.

59. Functions and Classification of Bone

a. Functions of Bone.

(1) To support and give shape to the body.

(2) To protect certain organs that might easily be injured.

(3) To furnish a system of levers which, when acted upon by muscles, permit movement of the body.

(4) As bone marrow, to manufacture red blood cells and certain white blood cells.

b. Types of Bones. Bones are classified by their shape as long, short, flat, and irregular.

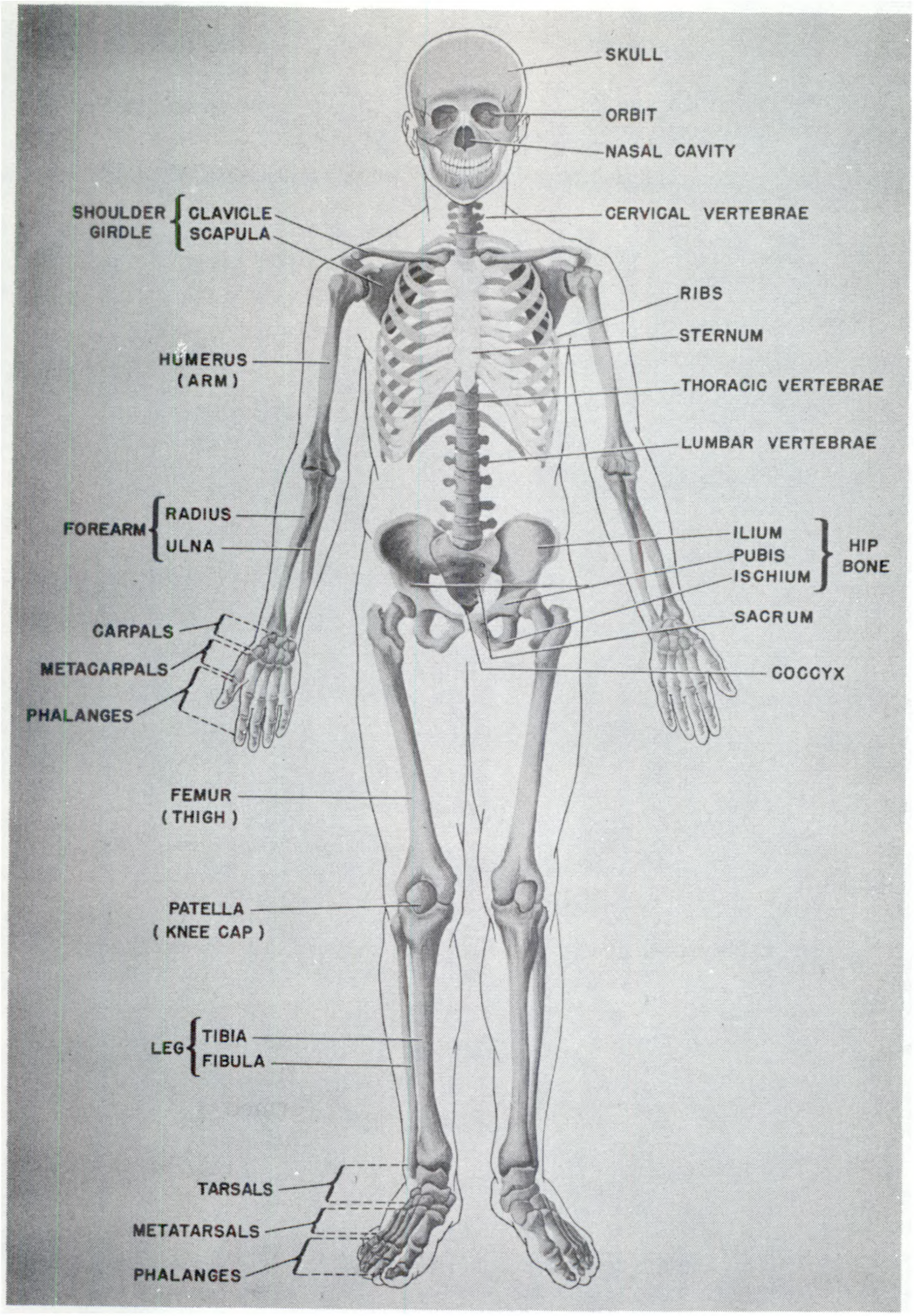


Figure 9. Human skeleton.

(1) Long bones, such as the humerus and femur, are found in the limbs where they act as levers and are weight bearing. A typical long bone (fig. 10) has a shaft and two extremities.

(2) Short bones are located in the skeleton where strength and compactness are essential; for example, in the wrist (carpal bones) and ankle (tarsal bones).

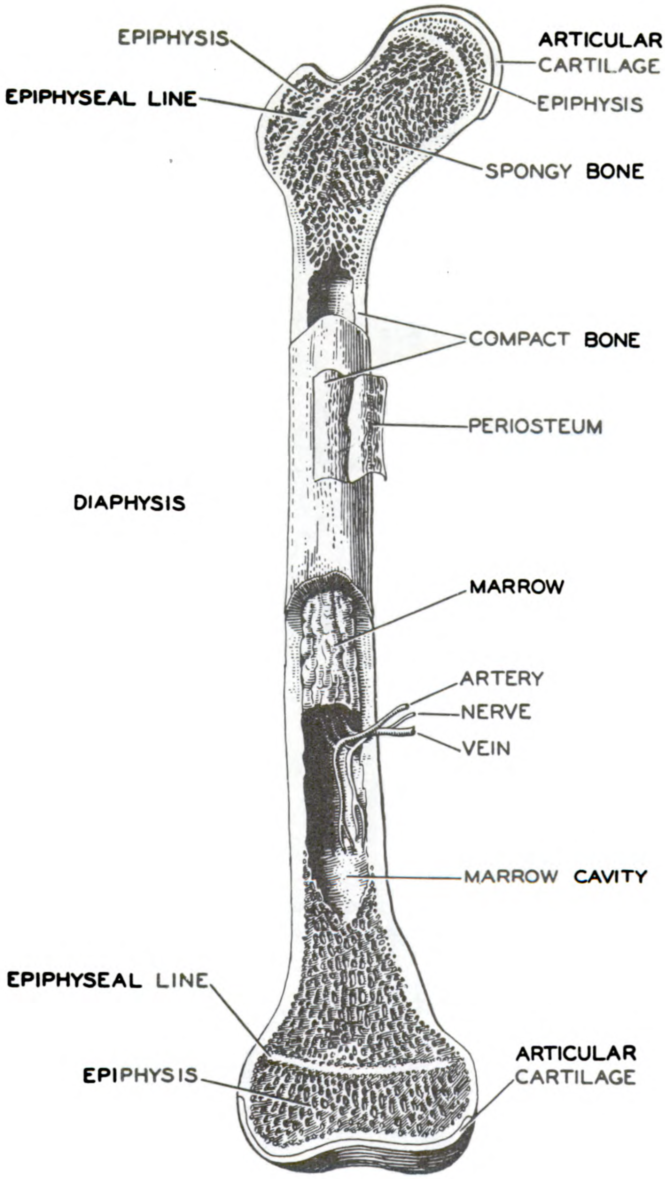


Figure 10. A long bone (femur).

(3) Flat bones are broad or elongated flat plates of compact tissues which protect some organs. Muscles may attach to their broad surfaces. Flat bones are found in the skull, ribs, and shoulder blades.

(4) Irregular bones are those of no particular shape; for example, the bones forming the pelvis.

60. Structure of Bone

a. Bone consists of a hard outer layer of *compact* bone tissue, an inner layer of *cancellous* or spongy bone tissue, and a central cavity (*medullary cavity*) filled with bone marrow (fig. 10). The layer

of compact bone is very hard and dense like ivory. Covering the entire bone, it is thick along the shaft and thin at the ends of the bone. Cancellous bone is made of the same material as compact bone but has a porous structure and contains less solid matter.

b. There are two types of bone marrow, yellow and red. Yellow marrow is composed chiefly of fat and is found in long bones. Red marrow contains a small amount of fat and many young cells from which white and red blood cells are formed. Red marrow is found in the vertebrae, bones of the skull, sternum, ribs, and the proximal ends of the humerus and femur.

c. The surface of bone is covered with a thin membrane, the *periosteum*, which contains nerves and blood vessels. The blood vessels nourish the bone cells. Additional blood for the bone is provided by an artery, the *nutrient* artery, which enters through an opening in the bone and reaches the medullary cavity. The periosteum plays an important role in the repair of broken bones.

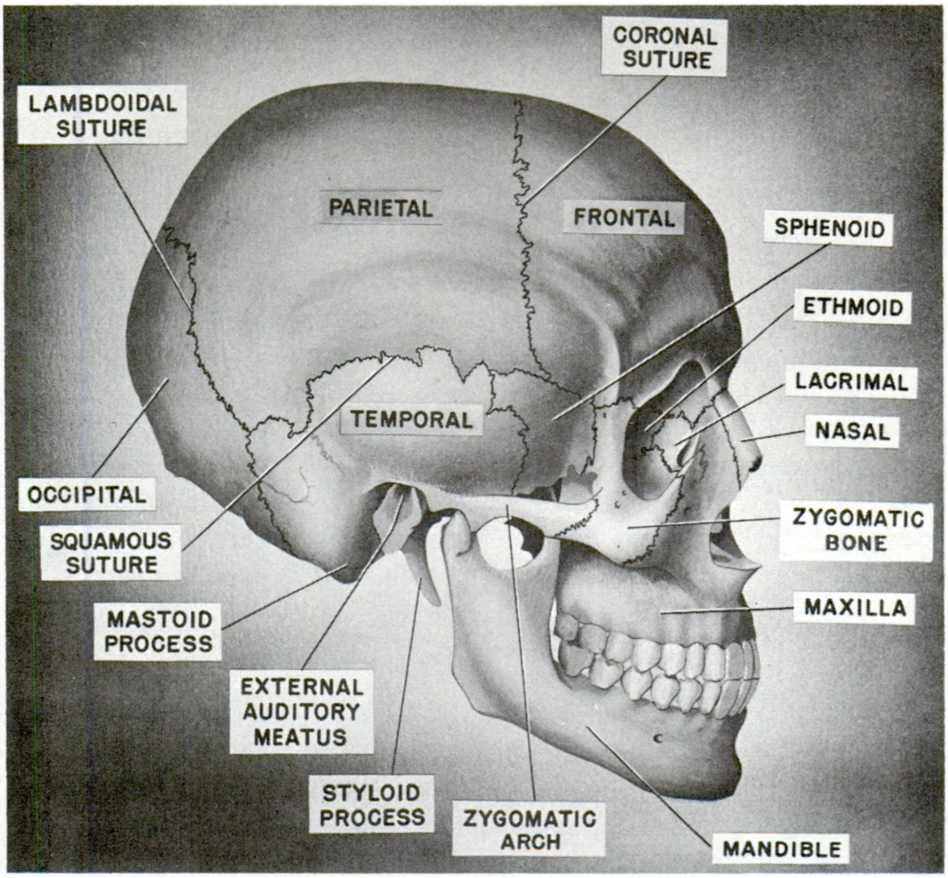
61. The Skull

(1, 2, and 3, fig. 11)

The skull is made of 22 bones, 8 of which form the cranium, and 14 the face.

a. Cranial Bones. The cranial bones support and protect the brain. They are so firmly united that no motion is permitted between them. The junctions of these bones along their edges are called *sutures*. The cranial bones include one *frontal*, two *parietal*, one *occipital*, two *temporal*, one *sphenoid*, and one *ethmoid*. The frontal bone forms the forehead and helps to form the eye socket (orbital cavity) and nose (nasal cavity) and the front part of the floor of the cranium. The two parietal bones form the roof of the skull and the upper part of each side. The occipital bone forms the back and base of the skull. In its lower part it has a large hole, the *foramen magnum*, through which the central nervous system passes from the skull into the spinal canal. The temporal bones form the lower part of each side of the skull and contain the essential organs of hearing and of balance. An opening in each temporal bone, the *auditory meatus*, leads from the outside to the ear drum. The sphenoid bone forms part of the floor of the cranial cavity. The ethmoid bone makes up part of the orbital and nasal cavities. The sphenoid, frontal and ethmoid bones contain air-filled spaces called *sinuses*.

b. Facial Bones. The facial bones complete the skull (3, fig. 11). The two *maxillary* bones help to form the upper jaw, roof of the mouth, orbit, and walls of the nose. The two cheekbones (zygomas) give prominence to the checks. The two *nasal* bones form the bridge of the nose. The two *palate* bones form the floor of the nasal cavity and roof of the mouth. The mandible forms the lower jaw. It is the only bone of the skull which is movable.

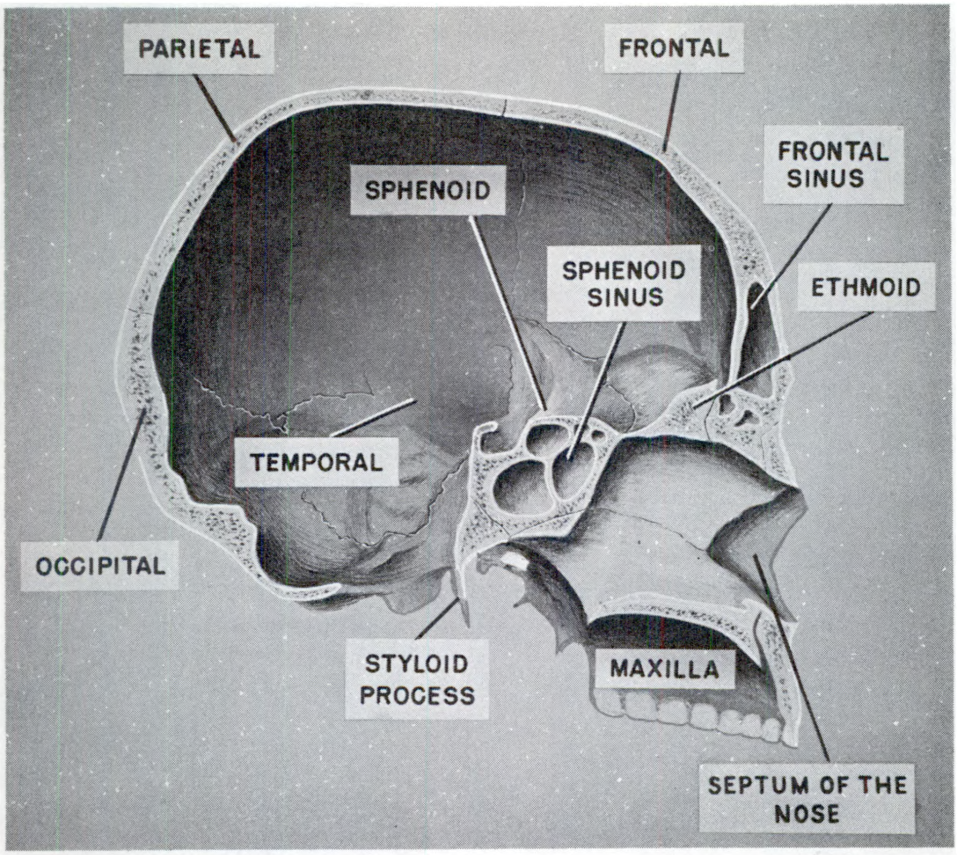


1 Lateral view
Figure 11. The skull.

62. Vertebral Column
(figs. 12 and 13)

The vertebral column is the backbone or spine, the central part of the skeleton. It supports the head, thorax, and upper extremities. The backbone also provides a protected passage for the spinal cord. The spinal cord (par. 133*d*) serves as a center for reflex actions and as a communicating pathway to and from the brain. Fractures or other injuries affecting the backbone are especially serious as they may damage the spinal cord and result in partial or complete paralysis. For this reason, patients with spinal injuries require especially careful handling. The vertebral column consists of five regions: *cervical* (neck), *thoracic* (chest), *lumbar* (lower back), *sacral*, and *coccygeal* (both contributing to the bony pelvis).

a. Vertebrae (fig. 12). A typical vertebra consists of an anterior portion, or *body*, and a posterior portion, or *arch*. The cavity between the body and the arch is the *spinal foramen*, through which the spinal cord passes. Most vertebrae have *spinous processes* which project posteriorly from the arch, and two *transverse processes*



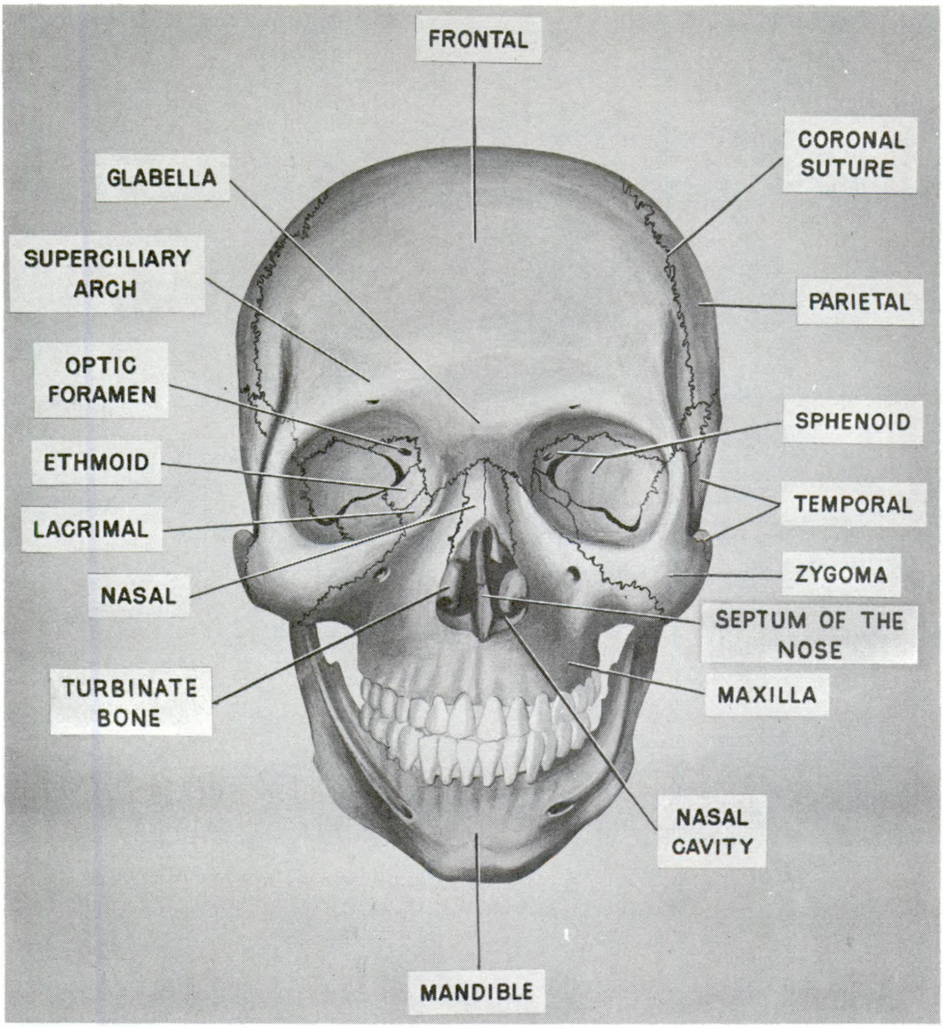
2 Median section
Figure 11—**Continued.**

which project laterally. Between the bodies of the vertebrae are the *intervertebral discs*, which are composed of fibrocartilage. Between the arches of the vertebrae are *intervertebral foramina*, through which the spinal nerves pass.

b. Classification of Vertebrae (fig. 13). There are seven cervical vertebrae. They occupy the region of the neck. The first cervical vertebra is called the *atlas*, the second vertebra, the *axis*. These are the only named vertebrae. All others are numbered. There are 12 vertebrae in the thoracic region which join with the ribs. They constitute the posterior wall of the thorax. There are five lumbar vertebrae in the lower back. The sacrum is a flat, spade-shaped bone, located between the two hip bones, which forms the posterior part of the pelvic girdle. The coccyx is a thin, curved bone, which forms the end of the spine.

63. The Thorax

The thorax, or chest cage, is formed by the sternum and rib cartilages in front, the 12 ribs on each side, and the bodies of the 12 thoracic vertebrae behind. The thorax contains and protects the



3 Frontal view
Figure 11—**Continued.**

heart, lungs, and other organs of circulation and respiration. It also helps support the bones of the shoulder girdle. The ribs form a series of curved bony bands that support the chest wall. Behind, they articulate (form a joint) with the thoracic vertebrae. In front, each rib is provided with a cartilage. The first seven pairs of ribs join the sternum by cartilages and are called *true ribs*. The lower five pairs of ribs are not so supported and are called *false ribs*. The upper three pairs of false ribs are joined to cartilages of the seventh ribs. The last two pairs are free at their anterior ends and are called *floating ribs*. The sternum, or breast bone, is flat. It occupies the middle of the upper part of the chest wall in front. The sternum joins above with the two clavicles and on each side with the cartilages of the first seven pairs of ribs.

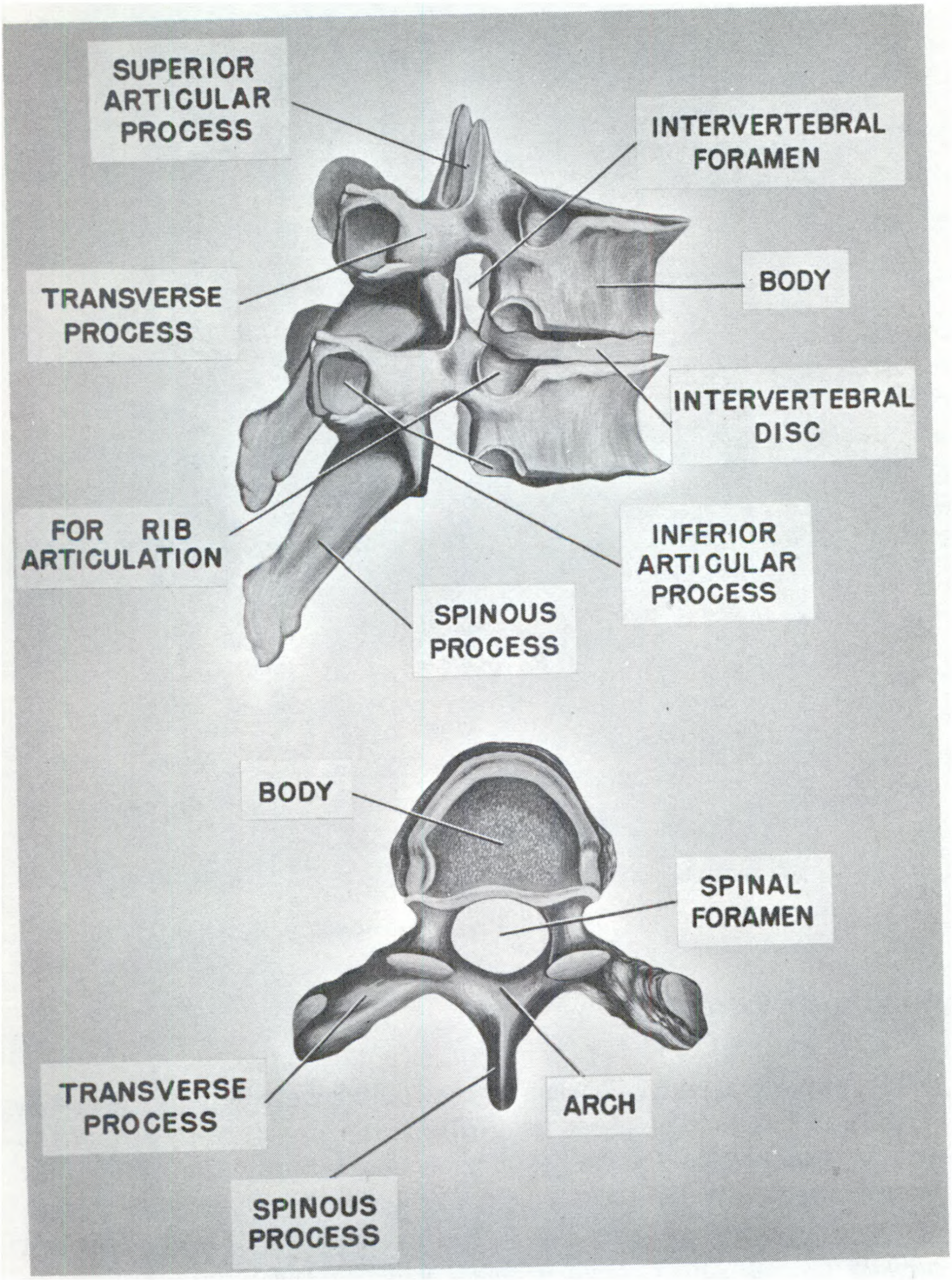


Figure 12. Typical vertebrae.

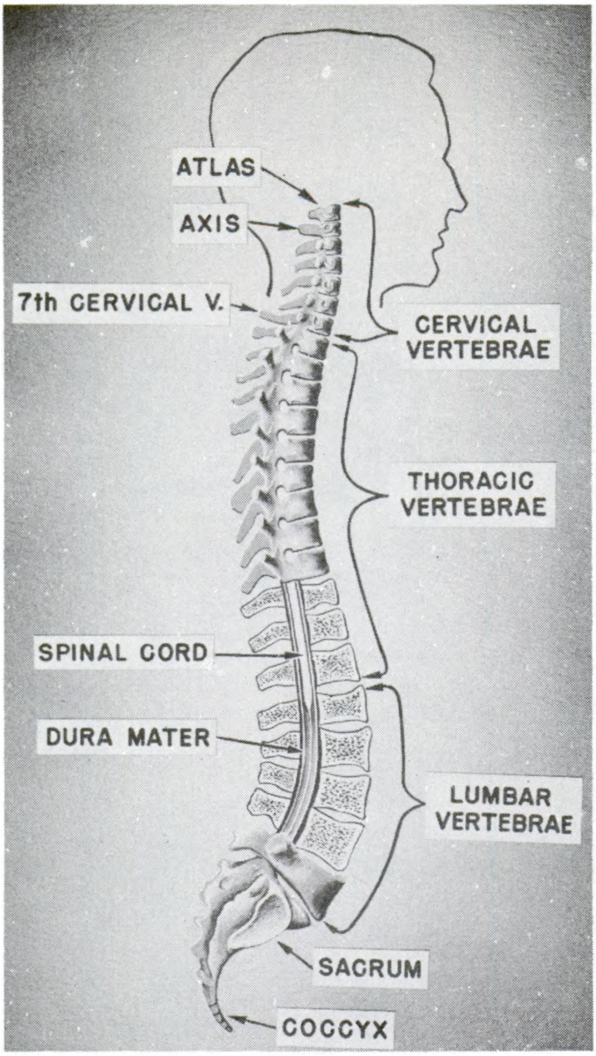


Figure 13. Vertebral column.

64. Upper Extremity

(figs. 9, 14, and 15)

The upper extremity consists of the shoulder girdle, arm, forearm, wrist, and hand. The shoulder girdle is the structure by which the arm is attached to the body. The bones forming the framework for the upper extremity are the *clavicle* (collarbone), *scapula* (shoulder blade), *humerus* (arm bone), *radius* and *ulna* (forearm bones), *carpals* (wrist bones), *metacarpals* (bones of the palm), and *phalanges* (finger bones). The shoulder girdle is held in place by muscles. The only bony connection with the trunk is the joint between the clavicle and the sternum. As a result, the shoulder girdle is extremely flexible. This flexibility and the superficial position of the clavicle make this structure liable to injury.

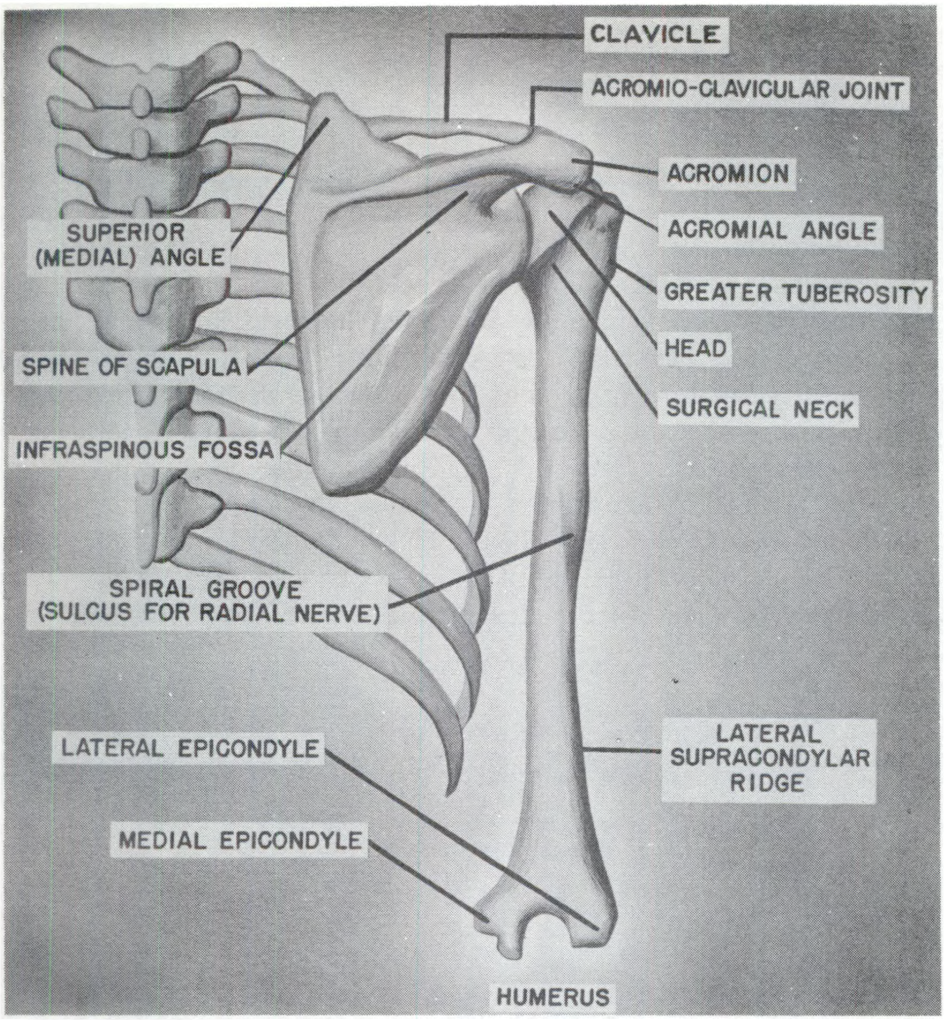


Figure 14. Shoulder girdle.

a. Clavicle (fig. 14). The clavicle forms the anterior part of the shoulder girdle. Shaped like a flattened letter "S", it is attached to the sternum medially and the scapula laterally. It lies in a horizontal position just above the first rib. Injury to the collarbone is common because the bone is long, thin, and close to the skin. A fall on the hand or on the point of the shoulder frequently will fracture the clavicle.

b. Scapula (fig. 14). The scapula forms the posterior part of the shoulder girdle. It is a large, triangular bone that lies against the back of the thorax extending from the second to the eighth rib. It has a heavy spine, the end of which forms a joint with the clavicle. The lateral angle of the bone forms a joint with the humerus. Fractures of the scapula are rare because of its position and the heavy muscular attachments that protect it.

c. Humerus. The humerus is the bone of the arm. It is a long bone, extending from the shoulder to the elbow (fig. 14). One end of the humerus, which is rounded, fits into the shoulder socket. The other end of the humerus joins with the bones of the forearm to form the elbow joint. Muscles surrounding the humerus protect the bone and blood vessels and nerves close to it. However, a fracture of the humerus can injure the muscle, blood vessels, or nerves.

d. Radius and Ulna. The radius and ulna are the bones of the forearm (fig. 15). The ulna joins the humerus in formation of the elbow joint. The ulna enters into formation of the elbow joint only slightly but forms the chief part of the wrist joint. The action of the radius and ulna permits turning of the hand. The bones of the forearm can be crossed to turn the palm down (*pronation*) or be paralleled to turn the palm up (*supination*).

e. Wrist and Hand (fig. 15). The wrist contains eight small bones (carpal bones) arranged in two rows of four each. They articulate with each other and with the bones of the hand and fore-

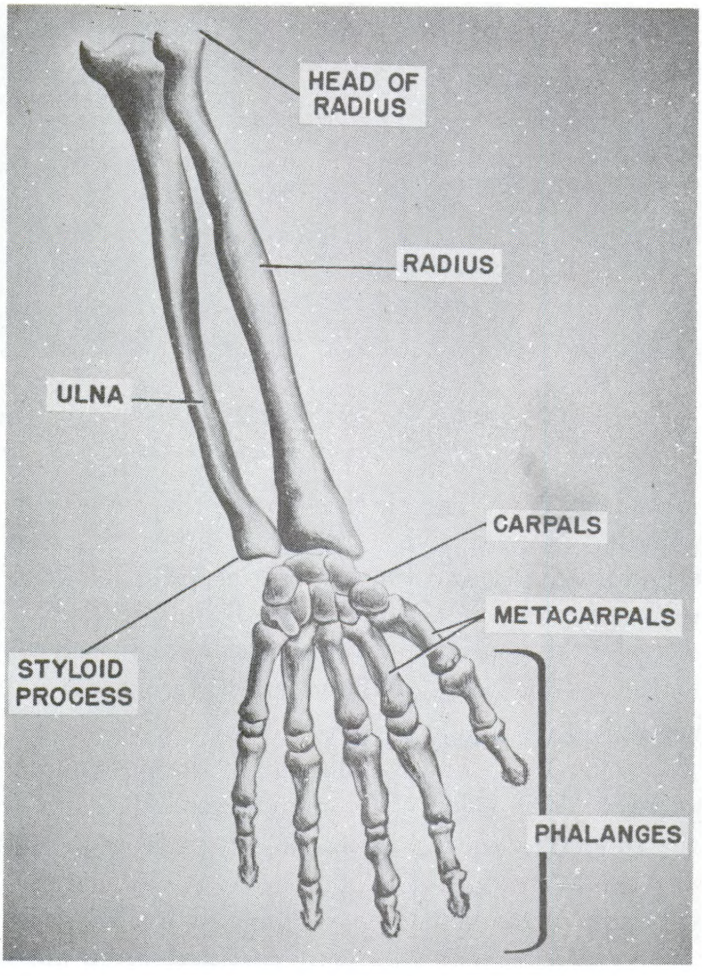


Figure 15. Forearm and hand.

arm. Articulating with the carpals are five metacarpals which form the bony structure of the palm of the hand. The metacarpals also articulate with the phalanges (bones of the fingers) to form the knuckle joints. There are 14 phalanges, three in each finger and two in the thumb. Tendons and nerves in the wrist are close to the surface. Lacerations may sever them and cripple the fingers.

65. Lower Extremity

(figs. 16, 17, and 18)

The lower extremity is attached to the trunk through the bony pelvis. It includes the hip, thigh, leg, ankle, and foot. Bones forming the framework for the lower extremity are the *hip bone*, *femur* (thigh bone), *patella* (knee cap), *tibia* and *fibula* (leg bones), *tarsals* (ankle bones), *metatarsals* (foot bones), and *phalanges* (toe bones).

a. Hip Bone. The hip bone is a broad, strong, curved bone that supports the backbone and transmits the weight of the rest of the body to the lower extremities. It provides the attachment for the muscles which move the lower extremities and trunk. It also protects the organs contained in the pelvic cavity: urinary bladder, rectum, and parts of the reproductive system. Each hip bone has three parts: the *ilium*, *ischium*, and *pubis*. The ilium is the broad upper portion

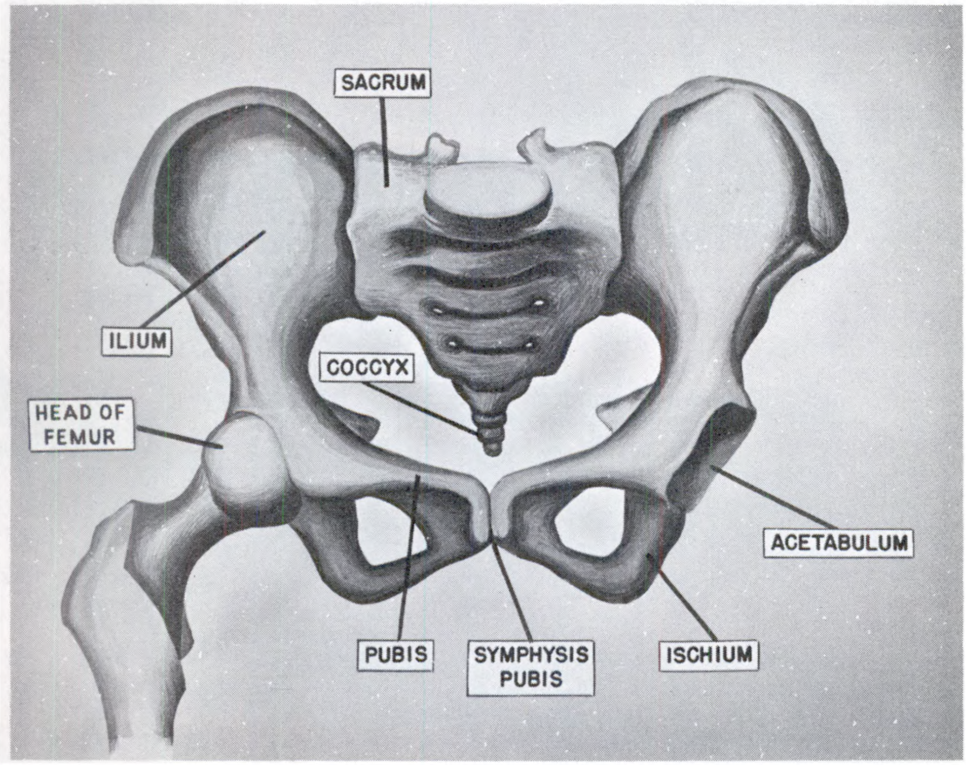


Figure 16. Pelvic girdle.

which flares out to the side. The ischium is the small lower part upon which a person sits. The pubis is the anterior part, situated in front of the bladder. It joins the pubis of the other hip bone to form a joint called the *symphysis pubis.* On the outer surface of the hip bone is a deep cup-shaped depression, the *acetabulum,* into which the rounded head of the thigh bone fits to form the hip joint. The two hip bones, with the sacrum and coccyx in the rear, form the pelvic girdle (fig. 16). In contrast to the shoulder girdle (par. 64), the pelvic girdle is inflexible and very strong. Fracture of the pelvis is dangerous, as broken fragments of bone may damage the bladder or other organs within the pelvic cavity.

b. Femur (fig. 17). The femur, or thigh bone, is the longest bone in the body. It is thickly covered with muscles. The upper end of the femur is rounded and has a head which fits into the acetabulum. The upper end also has a neck, the part of the femur most frequently fractured. The lower end of the femur articulates with the patella and the tibia, both of which enter into the knee joint.

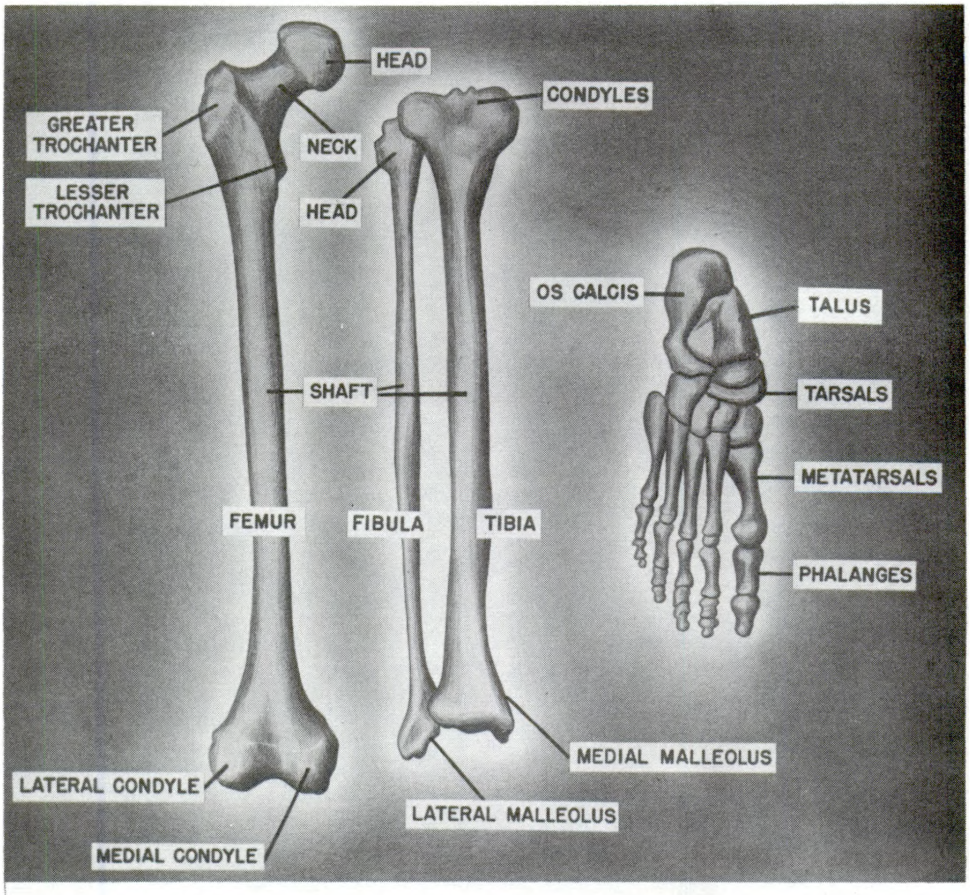


Figure 17. Bones of the lower extremity.

c. Patella (fig. 18). The patella, or knee cap, is a small bone which is oval in cross section. Protecting the front of the knee joint, the patella overlaps the lower end of the femur and the upper end of the tibia. This bone is contained within the tendon of the powerful group of muscles (quadriceps) extending down the front of the thigh. Fracture of the knee cap is a common injury. Bones such as this which develop within a tendon are known as *sesamoid* bones.

d. Tibia (fig. 17). The tibia, or shin bone, is the larger of the two bones of the leg. The tibia supports the weight of the body. Its proximal end articulates with the femur and the fibula. The distal ends of the tibia and fibula articulate with the talus to form the ankle joint.

e. Fibula (fig. 17). The fibula, or splint bone, is a long, slender bone situated on the outer side, buried under the muscles. It articulates with the proximal end of the tibia. Fracture of the fibula just above the ankle is a common type of fracture. Most of the blood

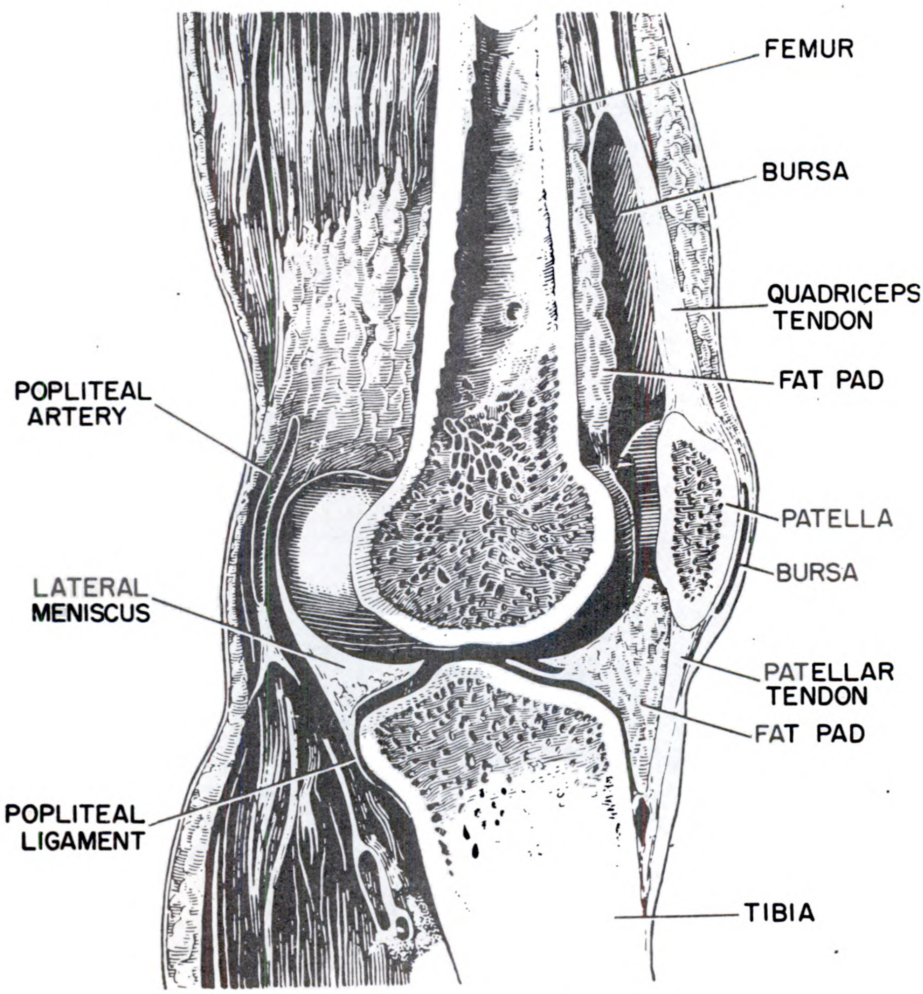


Figure 18. Knee joint, sagittal section.

vessels and nerves of the leg lie close to the bones and are protected by the muscles which surround them.

f. Foot. The skeleton of the foot consists of the *tarsals*, *metatarsals*, and *phalanges* (fig. 17). There are seven tarsal and five metatarsal bones. The metatarsals are similar in structure and arrangement to the metacarpal bones of the hand. They form the sole and instep of the foot. The phalanges form the toes and are similar in number, structure, and arrangement to the phalanges in the fingers.

66. Joints

(figs. 18 and 19)

A joint is a structure which holds together separate bones. Joints may be classified as *immovable*, *slightly movable*, and *freely movable.*

a. Immovable. These are joints which do not provide for motion. In these joints, the surface of the bones are fastened together by a thin layer of fibrous tissue or cartilage. Examples of this type of joint are found in the bones of the skull which are rigidly interlocked with one another (except for the mandible). These interlocking joints of the skull are called sutures.

b. Slightly Movable. These joints permit only a limited amount of motion. In slightly movable joints, the bony surfaces are separated by flat discs of cartilage and are held in place by fibrous ligaments which surround the joint. The symphysis pubis joint is a slightly movable joint.

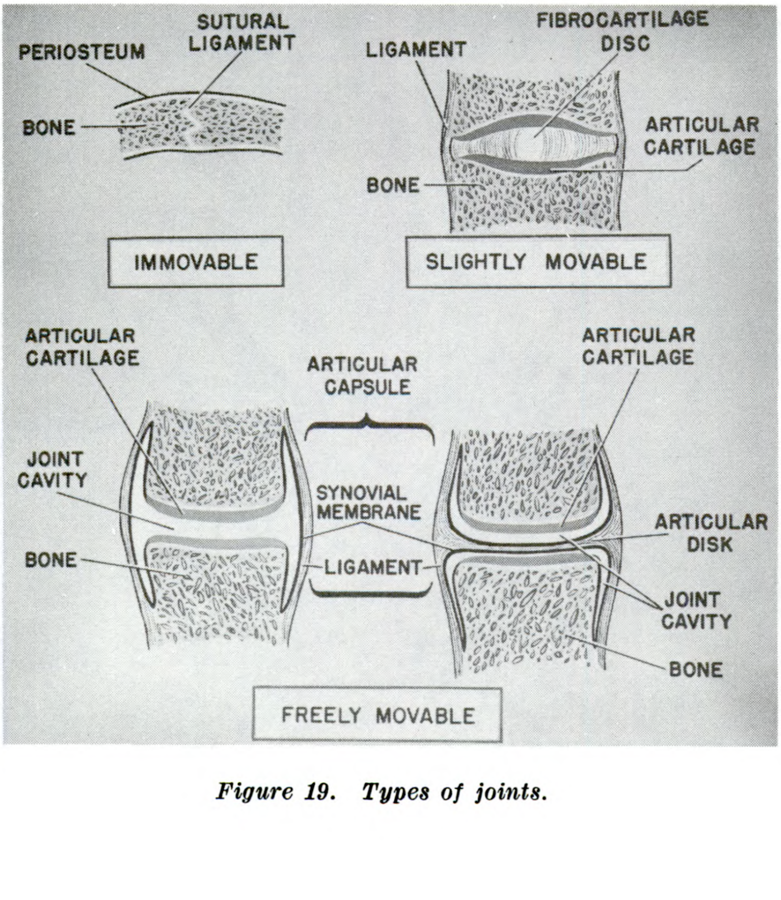


Figure 19. Types of joints.

c. Freely Movable. These joints permit maximum motion. They have a more complex arrangement than other types of joints. The surface of each bone is covered with an *articular cartilage.* The bones are connected by ligaments which pass from one to the other on all sides of the joint forming a capsule. The capsule is made of two layers. The outer layer is fibrous tissue. The inner layer is the synovial membrane, which secretes a lubricating fluid called synovial fluid. This fluid is contained in the joint cavity. The joint may be divided completely or incompletely by an *articular disc* attached to the capsule.

d. Types of Movable Joints. Some of the main types of movable joints are as follows:

(1) *Hinge joint*, such as the elbow and knee.

(2) *Ball and socket joint*, in which the round head of one bone fits into a cup-like cavity of another, such as the shoulder and hip.

(3) *Gliding joint*, where the surfaces of adjacent bones glide upon each other, as in the wrist.

(4) *Pivot (or rotary) joint*, where one bone pivots or rotates about another which is stationary, such as the axis about the atlas.

e. Types of Motion. Joints are capable of several types of motion. The following terms are used to define the types:

(1) *Flexion.* Bending, as in bending (flexing) the forearm on the arm, the fingers on the palm of the hand.

(2) *Extension.* Straightening or unbending, as in straightening (extending) the forearm or fingers.

(3) *Abduction.* Movement of an extremity away from the midline.

(4) *Adduction.* Movement of an extremity toward the midline.

(5) *Rotation.* Turning a part about its long axis.

(6) *Pronation.* Turning the forearm so that the palm of the hand is down.

(7) *Supination.* Turning the forearm so that the palm of the hand is up.

67. Bursae

(fig. 18)

A bursa is a closed sac with smooth walls and containing a small amount of fluid. Bursae are located between surfaces and glide over each other. They lie between tendons and the surface on which the tendons glide, or between the skin and bony prominences. They reduce friction at these places; that is why the skin is loose and slips freely over the knuckles, elbows, shoulders, knees, and heels. When bursae become inflamed (bursitis), movements cause pain.

Section III. MUSCULAR SYSTEM

68. Muscle

Muscle is characterized by the ability to contract, or to shorten. The power of contraction enables a muscle to move parts of the body. All movements of the body, whether conscious or unconscious, are due to the action of muscles. Muscle constitutes much of the fleshy portions of the body. It enters into the structure of many internal organs and forms 40 to 50 percent of the weight of the body. The muscles of the body vary in shape and structure according to the work they have to do. There are three main types of muscle: *voluntary*, *involuntary* (smooth), and *cardiac* (heart).

69. Voluntary Muscle

Voluntary muscle is so called because it is controlled by will through the central nervous system. All the *skeletal muscles* (those attached to the skeleton) are of the voluntary type. Because microscopic examination shows it to be cross-hatched, voluntary muscle is known also as *striated* muscles. Besides the skeletal muscles, those which move the eyeballs, tongue, and pharynx are voluntary.

a. Functions. The voluntary muscles cause the movements of the body as a whole and the movements of its parts. They perform all voluntary and reflex movements. They maintain posture, carry on the rhythmic movements of respiration, and produce most of the heat generated in the body.

b. Structure. This type of muscle is made of long, slender fibers, held together by connective tissue to form muscle bundles. Groups of muscle bundles, inclosed in a fibrous sheath called *fascia*, form the individual muscles.

c. Parts. A skeletal muscle has three main parts: *belly*, *origin*, and *insertion*. The belly is the body of the muscle. Tendons extend from each end of the belly and attach to bones. A *tendon* is a band of tough, nonelastic fibrous tissue. Tendons unite with the periosteum of bones to form secure attachments for the muscles. The origin of the muscle is that portion which accomplishes least movement when the muscle is contracted. The insertion is the most movable end of the muscle. It is the point where the action of the muscle is applied to secure movement of body parts. Sometimes it is hard to be definite about the origin and insertion of muscle because the end that moves may depend on the activity of associated muscles. In other words, sometimes the origin and insertion may be reversed.

d. Names. Each muscle has a name. Some muscles are given names derived from their location. Examples of these are the *intercostal* muscles, between the ribs. Muscles are named by other distinguishing features, such as their action, shape, size, or points of attachment. The *flexor* muscles are so called because of their action.

The *sternocleidomastoid* muscle gets its name from places of attachment, the sternum, clavicle, and mastoid process. The *adductor magnus* is so named because it is the largest adductor muscle of the thigh.

70. Involuntary (Smooth) Muscle

The involuntary muscle is so called because its nerve supply is from the autonomic nervous system, which is not under the control of the will. Since this type of muscle is not striated, it is called *smooth* muscle. Smooth muscle is found in the walls of the blood vessels, respiratory passages, gastrointestinal tract, ureters and urinary bladder, and certain other organs.

a. Functions. Smooth muscle performs many varied functions. It regulates the size of blood vessels, which is essential to the maintenance of blood pressure. It moves food through the intestinal tract. It regulates the bronchioles (small air passages) in the lungs. Still another function of smooth muscle is the movement of urine from the kidneys to the outside.

b. Structure. Smooth muscle is made of spindle-shaped cells of fibers. The fibers are arranged in bundles or sheets to form a layer in the walls of blood vessels and other viscera. Connective tissue binds the layer of smooth muscle to other parts of the wall.

c. Cardiac Muscle. Cardiac, or heart, muscle is involuntary muscle but it is found only in the heart. The structure of cardiac muscle is different from that of other muscles. The fibers are much smaller and have very faint striations. Cardiac muscle forms the walls of the heart. The whole heart works together because all parts are connected with special bands of cardiac muscle.

71. Action of Voluntary Muscles

a. A muscle seldom works alone in carrying out a movement. Usually the performance of a movement, even a simple motion, requires the combined action of a group of muscles. Many skeletal muscles are arranged in pairs; for each muscle producing one motion there is another muscle which produces the opposite motion. One muscle must relax in part while the other contracts. For instance, in movements of the arm, the biceps and the triceps muscle oppose each other. When the arm is extended, the triceps muscle is contracted and the biceps muscle relaxed. When the arm is flexed, the biceps is contracted, the triceps relaxed.

b. At all times, muscle is in a state of partial contraction called *tone* or *tonus.* Because of this, when a muscle is cut, the two ends pull apart like the cut ends of a stretched rubber band. Tone in skeletal muscle is maintained by a reflex and, therefore, depends on nerve connections to a functioning spinal cord.

c. Muscle contraction uses food and oxygen and produces acids and heat. Muscle activity is the major source of the body's heat. Acids accumulating as a result of continued activity cause *fatigue.* Muscle fatigue occurs most rapidly when contractions are frequent; it occurs slowly if rest periods are taken between contractions. Exercise causes muscles to become larger, stronger, and better developed. This increase in size is called *hypertrophy.* Inactivity results in wasting away of muscles called *atrophy.* Physical exercise is necessary to keep muscles in good condition.

d. Voluntary muscle activity results from impulses which arise in the cortex of the brain and are transmitted to the muscle by the spinal cord and the *motor* nerves. Interruption of any part of this pathway will cause *paralysis*, the loss of voluntary control. If a motor nerve is damaged, it may regenerate slowly, resulting in a return of voluntary control. If the pathways in the brain or spinal cord are cut, there is no regeneration, and permanent paralysis of the muscle results.

72. Principal Groups of Skeletal Muscles

A description of each of the skeletal muscles of the body can be found in any of the standard anatomy books. This manual gives a general discussion of the principal groups of skeletal muscles (1 and 2, fig. 20) and describes individually some of the more important muscles of the extremities.

a. Head and Face. The muscles of the head and face are small and numerous. They act in the movements of the eye and face, making possible facial expression, talking, chewing, and swallowing.

b. Neck. The muscles of the neck move the head from side to side, forward and backward, and rotate it. Some of them also assist in respiration, speaking, and swallowing.

c. Arm. Among the muscles which cause movement of the arms are the *deltoid*, *biceps*, and *triceps.*

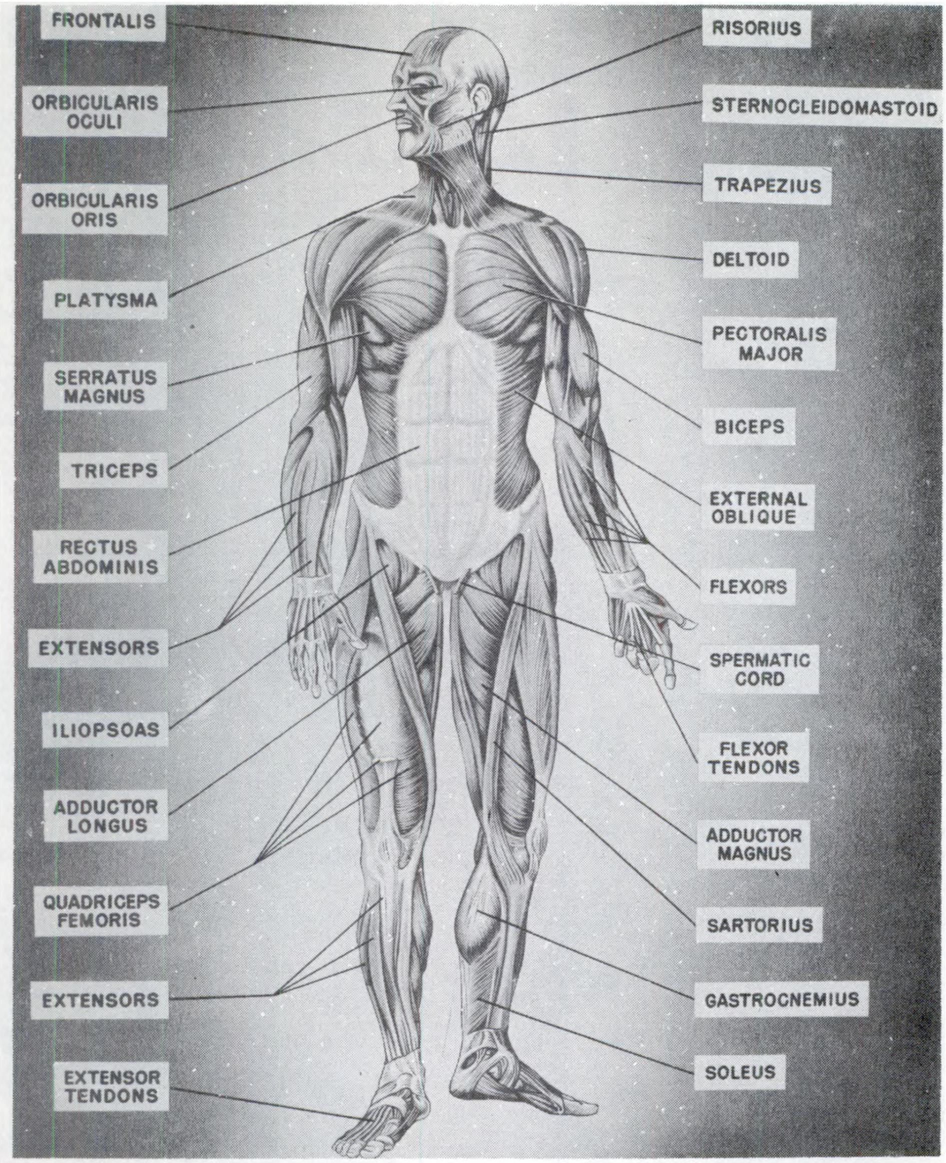
(1) The deltoid is a triangular shaped muscle located on the shoulder and upper arm. This muscle lifts the arm forward, sideways, and to the rear.

(2) The biceps is a long muscle located on the front of the arm. Its action is to flex the arm.

(3) The triceps is a large muscle located on the back of the arm. Its action extends the arm at the elbow.

d. Back. The muscles of the back are large and some are broad. Attached to vertbrae, they keep the trunk in an erect posture and aid it in bending and rotating. In the thoracic region, these muscles assist in respiration and in the movements of the neck, arm, and trunk.

e. Abdominal. The abdominal muscles form broad, thin layers which support the internal organs, assist in respiration, and help in



1 Anterior

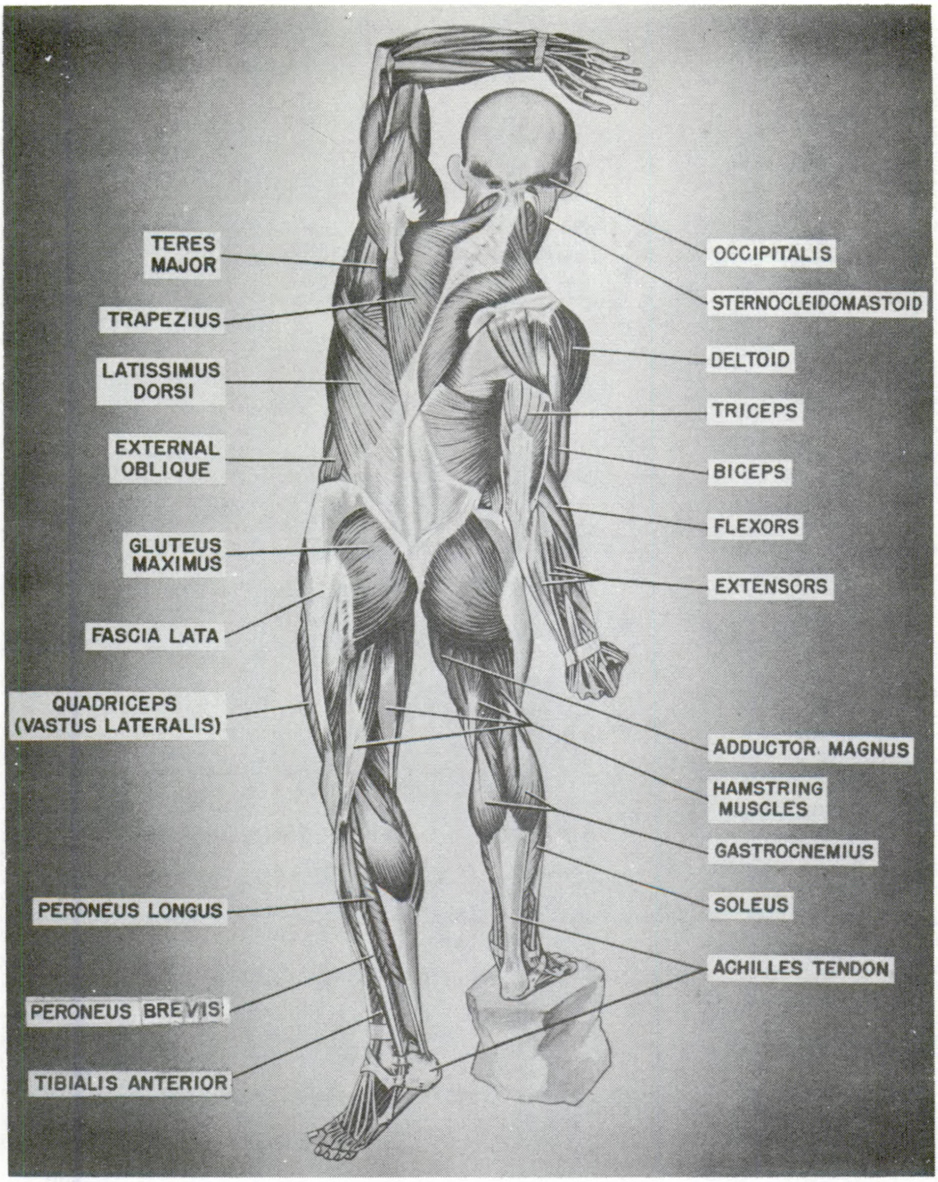
Figure 20. Superficial muscles of the body.

flexion and rotation of the spine. The diaphragm separates the thoracic and abdominal cavities. It is an important muscle used in breathing. The abdominal muscles also assist in defecation and urination.

f. Perineal. The muscles of the perineum form the floor of the pelvic cavity and aid in defecation and urination.

g. Thigh. The muscles located on the front and rear of the thigh cross two joints, the thigh and the knee. When they contract they extend one joint and flex the other.

(1) *The quadriceps femoris*, a four-headed group of muscles located on the front of the thigh, extend the leg at the knee



2 Posterior
***Figure 20*—Continued.**

and flex the hip. The four muscles are *vastus lateralis*, *rectus femoris*, *vastus intermedius*, and *vastus medialis*.

(2) Muscles located on the rear of the thigh flex the knee and extend the leg. Among them are the gluteal muscles, the *gluteus maximus*, *gluteus medius*, and *gluteus minimus*. These muscles abduct the thigh and rotate it medially.

h. Leg. The most important muscles of the leg are the anterior and posterior groups. An important member of the anterior group is the *anterior tibialis*, which flexes the foot. The most superficial, and largest, muscle of the back of the leg is the *gastrocnemius*. Commonly called the calf muscle, the gastrocnemius flexes the foot.

Section IV. THE SKIN

73. Description

The skin is a tough, elastic structure covering the entire body (fig. 21). It is made of two principal layers. The outer layer is the *epidermis*. The inner layer is the *dermis*, or true skin. The epidermis is composed of a superficial layer and an inner layer. The superficial or horny layer consists of dead cells which are constantly being worn off. These are replaced from the living cells which form the inner layer. The dermis is the thicker part of the skin and consists of connective tissues containing blood vessels, nerve endings, sweat glands, sebaceous glands, and hair follicles. The dermis is held in place by a layer of connective tissue.

74. Functions of the Skin

a. Protection. The skin covers and protects underlying structures from injury or bacterial invasion.

b. Regulation of Body Temperature. The skin helps to regulate the body temperature (par. 76) by controlling the loss of heat from the body. To increase heat loss, the arterioles and capillaries of the skin dilate, and the increased blood flow brings more heat to the skin. Then the skin temperature rises and more heat is lost from the hot skin. Of even greater importance in heat loss is the evaporation of

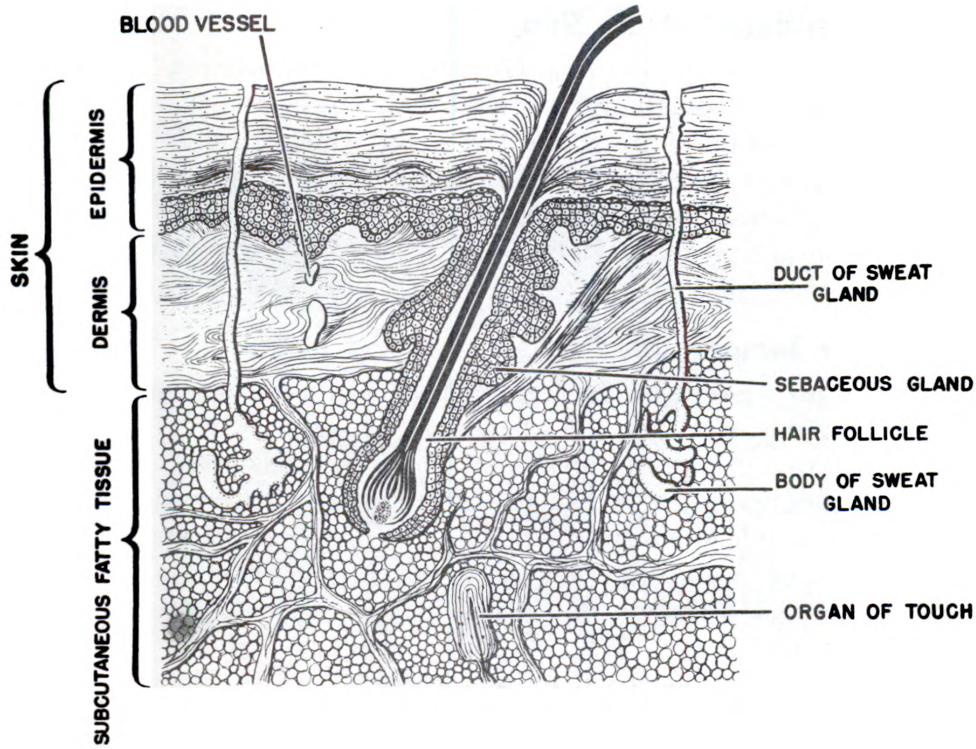


Figure 21. Structure of the skin (semidiagrammatic).

sweat. It carries heat away from the skin. To conserve heat sweating stops, blood arterioles carry less heat to the skin, and the skin temperature falls, decreasing heat loss.

c. Sensory Perception. The skin also serves as a sense organ. It contains sensory nerve endings specialized to detect heat, cold, pressure, touch, and pain.

d. Excretion. The skin excretes wastes as sweat. However, sweat is more important as a way for losing body heat than as an excretory substance. Release of sweat is a function of the sweat glands which open by ducts, or pores, onto the skin surface. Sweat glands are distributed over the entire skin. Some fluid is being lost as sweat at all times, but if it evaporates as fast as it is formed, the skin sometimes may be quite dry. Sweat consists chiefly of water (99%), with small quantities of salts and organic materials which are waste products. Skin also secretes a thick oil substance, *sebum.* This material, produced by the *sebaceous glands*, lubricates the skin and keeps it soft and pliable.

e. Absorption. Although this is not one of its normal functions, the skin can absorb water and other substances. This property of the skin is used to advantage in prescribing local application of certain drugs. It can be harmful too, as when toxic agents such as "G" gas, lead salts in gasoline, and insecticides are absorbed and permitted to enter the body through the skin.

75. Appendages of the Skin

The appendages of the skin include the glands (sweat and sebaceous), the hair, and the nails. Each hair consists of a shaft which projects beyond the skin surface and a root which is implanted in the skin. Each root is set in a fold of skin called the hair *follicle.* The sebaceous glands open into the follicles. A fingernail or toenail grows from a nail-bed. If the bed is destroyed, the nail will stop growing.

76. Body Temperature

a. General. Every living person has a certain normal temperature. This temperature is maintained by heat produced when food which has been eaten is burned (metabolized) by the cells of the body. In health the temperature remains fairly uniform but it varies slightly in normal people with the time of day. Usually, it is lowest in the early morning and highest in the evening. The average oral temperature is 98.6° Fahrenheit. In many diseases the body temperature changes from normal. When it goes above the normal, the patient has a "fever" or "elevation of temperature." This change can be caused by several conditions, the most important of which is infection by bacteria. The infection may be either local (as a boil) or general (as with septicemia or blood poisoning). When the body

temperature goes below normal, the patient has a "subnormal" temperature.

b. Factors Influencing Body Temperature.

(1) Time of day.

(2) Physical activity of patient.

(3) Infection.

(4) Drugs.

(5) Environmental stress, such as heat, cold, humidity, wind velocity, and radiation from the sun.

(6) Exposure to heat-producing electrical current.

(7) Malfunction of glands of internal secretion.

c. Shivering. Increase in muscular exercise increases the amount of heat produced within the body. Shivering is an unpleasant involuntary muscular activity which adds to the body's heat when a cold environment threatens to lower the temperature of the body. Hard work and shivering are equally effective in warming the body.

d. Chill. A high body temperature or fever is one of the body's defenses against infection. During an illness when this defensive temperature is developing, the patient feels extremely cold as long as the temperature is rising. During this time, a shaking chill may occur which, like shivering, adds to the body's heat. A chill is treated by helping the body reach the temperature it needs for defense. For this purpose, hot water bottles and extra blankets are used, even though the patient's body temperature may already be above his normal level. When the fever level is reached, the patient no longer feels cold and shivering stops. When body temperature begins to fall, the patient feels very warm and may sweat. In general, a chill signals a rising temperature, the end of the chill signals the peak of the bout of fever, and sweating signals a temperature which is falling toward normal.

Section V. CIRCULATORY SYSTEMS

77. Description

a. The main function of the circulatory system is to circulate blood to the tissues of the body, to which it brings oxygen and food for use by the tissue cells and from which it removes carbon dioxide and other waste products.

b. The circulatory system consists of the *blood vascular* system and a drainage system called the *lymphatic system.* The systems are connected but each has its own set of organs or vessels and carries its special fluid.

78. Blood Vascular System

(fig. 22)

The blood vascular system is composed of the heart and the blood vessels. The vessels are the *arteries*, *capillaries*, and *veins*.

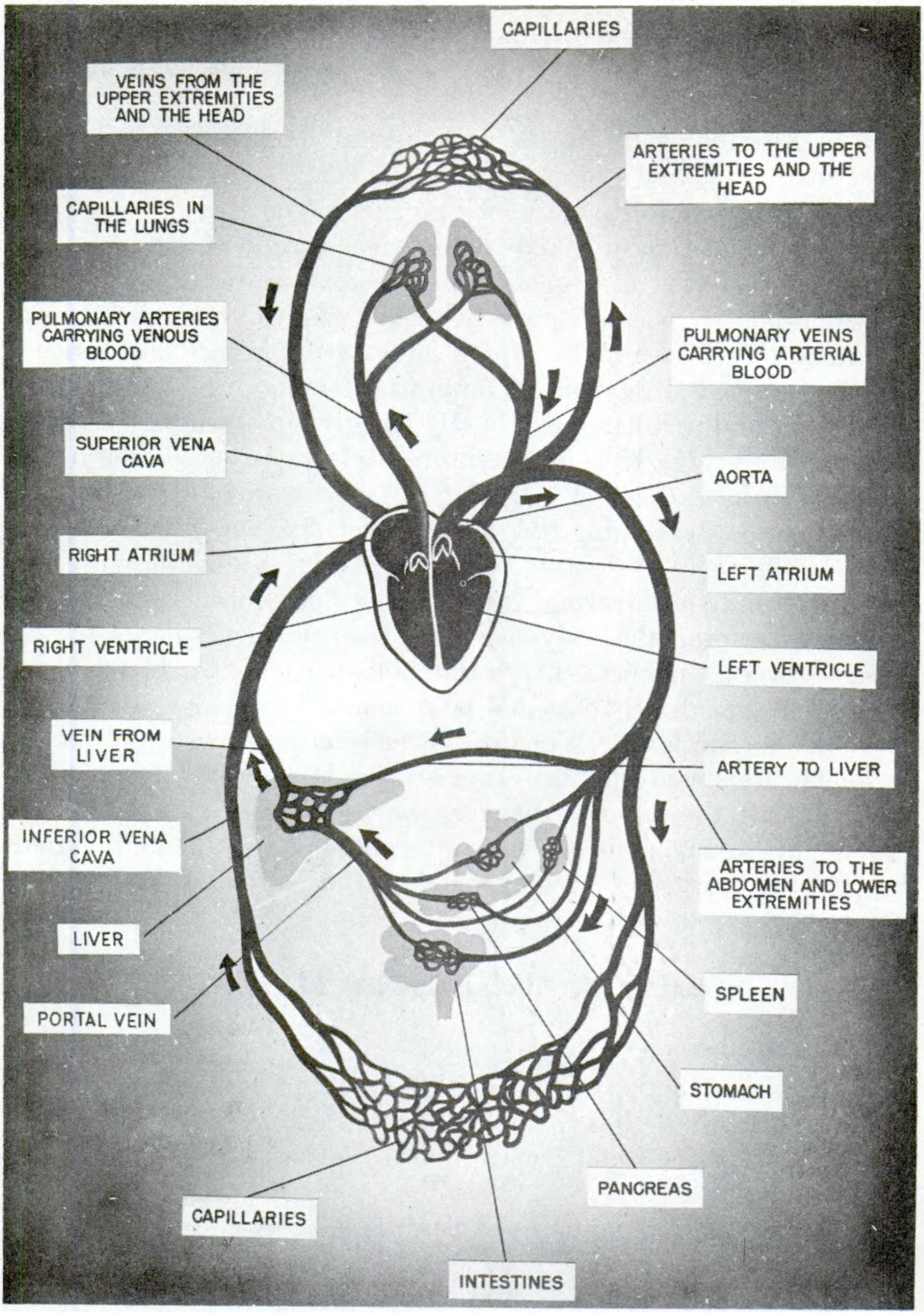


Figure 22. Diagram of blood vascular system.

79. Blood Vessels

a. Arteries (fig. 23). These are the vessels which carry the blood away from the heart. Their walls have a layer of elastic, muscular tissue which allows them to stretch and recoil. Very small arteries are called *arterioles*. The system of arteries and arterioles is like a tree with the large trunk giving off branches which repeatedly divide and subdivide, becoming progressively smaller.

b. Capillaries. The capillaries carry blood from the arterioles to the *venules* (smallest veins). Capillaries are the smallest blood ves-

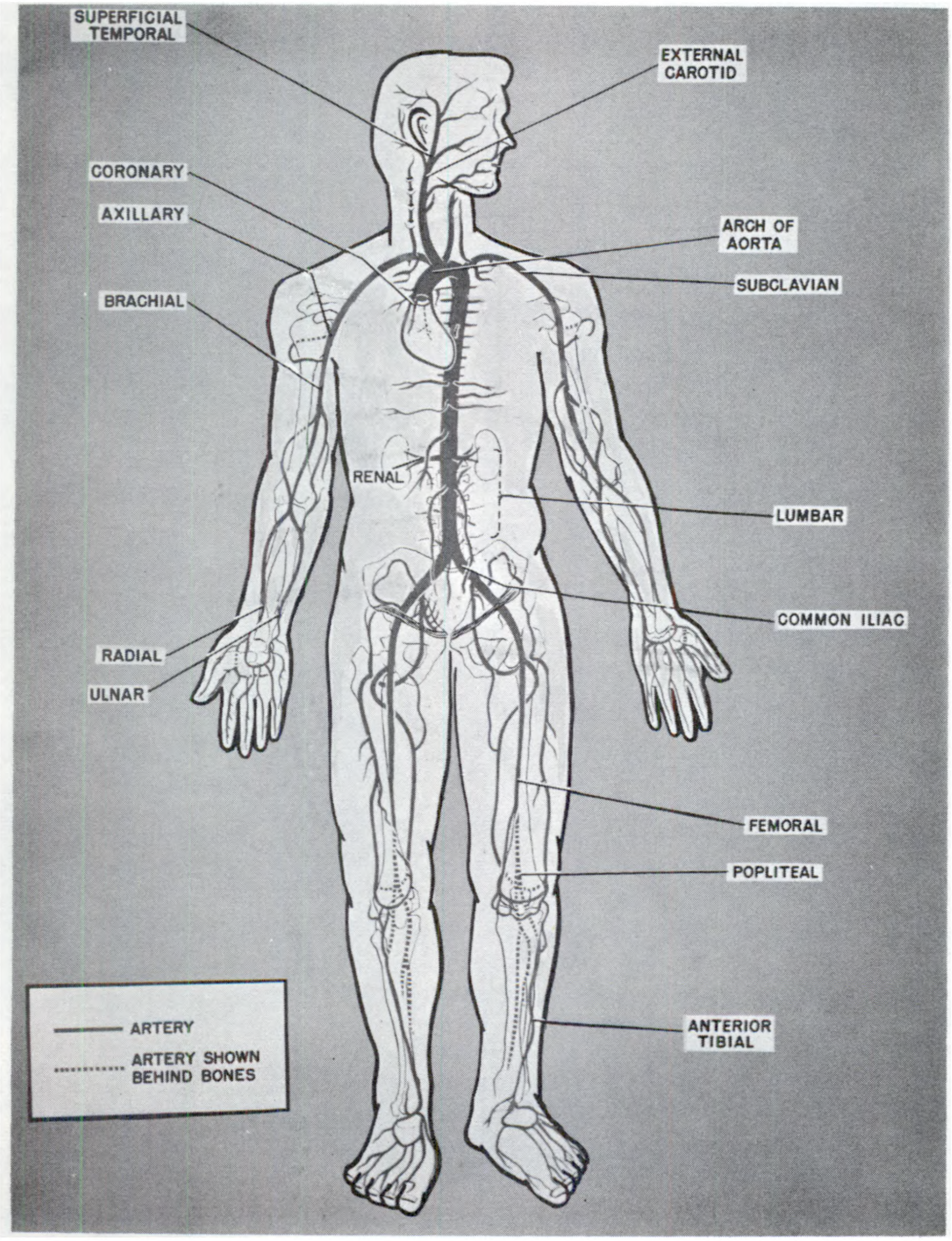


Figure 23. Principal arteries.

sels in the body. Their walls have no muscle but are made of a very thin layer of tissue. The thin wall permits exchange of fluid, oxygen, and carbon dioxide between the blood and the tissue cells. Capillaries are so numerous that there is one or more near every living cell.

c. Veins (fig. 24). These are the vessels which carry blood back to the heart. They are characterized by thin walls and low pressure

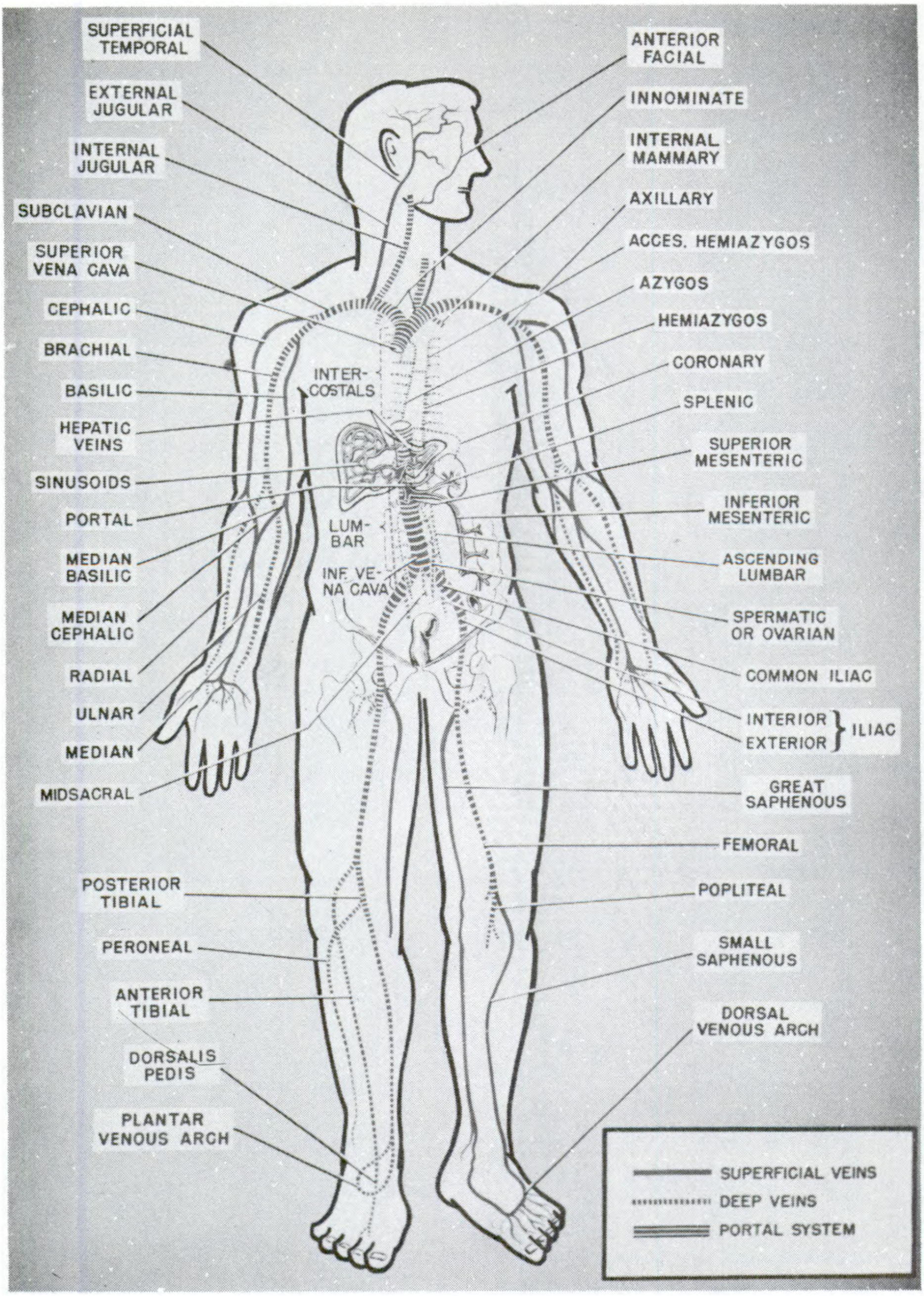


Figure 24. Principal veins.

and by their valves which prevent blood from flowing back toward the capillaries.

80. The Heart

a. Location. The heart is a hollow, muscular organ situated in front of the chest between the lungs, with about two-thirds of its mass to the left of the midline.

b. Pericardium. The heart is enclosed in a double-walled sac called the *pericardium.* The sac contains a small amount of fluid which lubricates the outside of the heart as it beats. In certain heart diseases the amount of fluid may increase greatly and interfere with the heart. At other times the fluid may disappear so that a *friction rub* can be heard with a stethoscope when the heart beats.

c. Chambers of the Heart. The interior of the heart is divided into right and left halves by a muscular wall. Each half is further divided into an upper chamber, the *atrium*, and a lower chamber, the *ventricle* (fig. 25). Consequently there are four chambers in the heart: two atria and two ventricles. An opening (valve) connects each atrium with its corresponding ventricle (that is, the one on the same side).

d. Valves of the Heart. The four chambers of the heart are lined with endocardium. At each opening from the chambers this lining folds on itself and extends into the opening to form valves (fig. 25). These valves allow the blood to pass from a chamber but prevent its return. The two valves located between the upper and lower chambers are called the *atrioventricular* valves. A third valve is located between the right ventricle and the pulmonary artery, a fourth valve between the left ventricle and the aorta. The third and fourth valves are called *semilunar* valves.

e. Blood Supply of the Heart. The heart gets its blood supply from the right and left coronary arteries. These arteries branch off the aorta just above the heart, then subdivide into many smaller branches within the heart muscle.

f. Nerves of the Heart. The heart is under the control of two sets of nerves which keep its activity in balance. They are the *vagus* nerves, which keep the heart beating at a slow regular rate, and the *accelerator* nerves, which speed up the heart. Both sets of nerves are part of the involuntary nervous system.

81. Flow of Blood Through the Heart

To understand the structure and functioning of the heart, it is helpful to follow the course of blood flowing through it and to consider each chamber individually. In doing so, bear in mind that three main actions take place:

Deoxygenated blood is returned to the heart from all the tissues of the body by the veins.

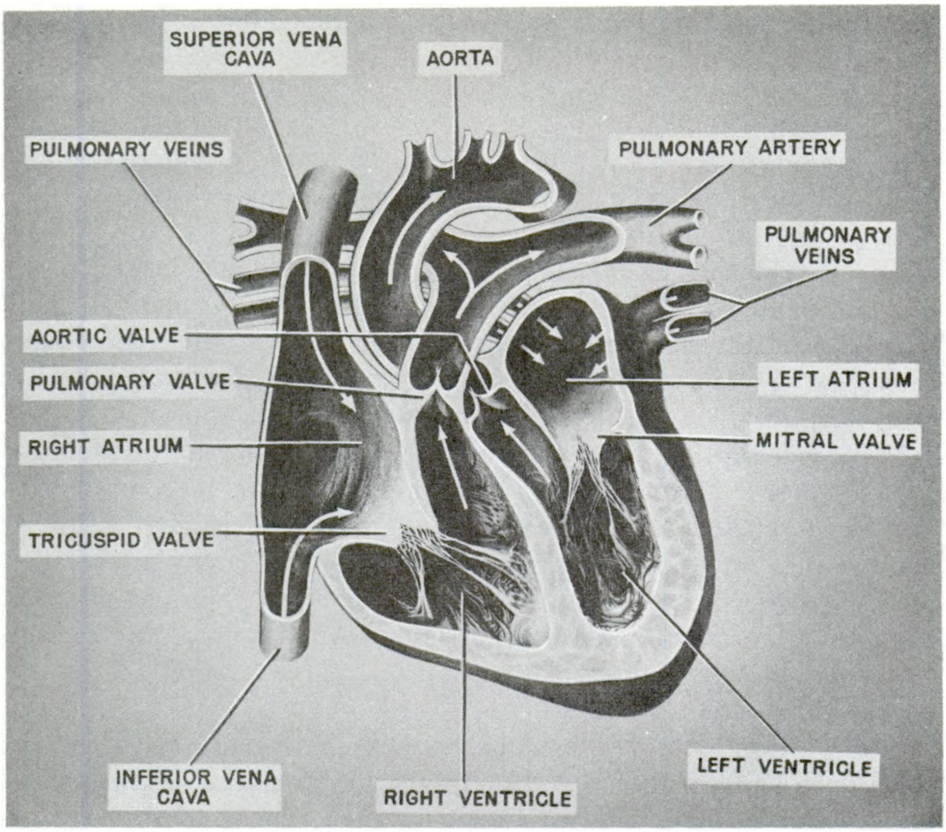


Figure 25. The Heart, showing the flow of blood.

Deoxygenated blood is pumped into the lungs where it loses part of its carbon dioxide and receives oxygen.

The purified oxygenated blood is returned again to the heart and then is pumped out through the arteries to all the body tissues (fig. 22).

a. Blood from the upper part of the body enters the right atrium through a large vein, the superior vena cava, and from the lower part of the body by the inferior vena cava. The right atrium contracts and blood is forced through the open valve into the right ventricle.

b. The right ventricle contracts and the valve closes. Then the pulmonary semilunar valve opens and blood is forced to the lungs through the pulmonary artery.

c. After circulating through the lung tissues, the blood passes along the pulmonary veins to the left atrium. When the left atrium contracts, blood is forced through another valve into the left ventricle.

d. As the left ventricle contracts, the valve closes and blood is ejected through a large artery, the aorta, into the circulation of the body.

82. The Cardiac Cycle

The action of the heart occurs as a cycle repeated continuously and in regular rate and rhythm. This cycle consists of alternate contraction and relaxation of the heart. The phase of contraction, during which blood is forced from the chambers, is known as *systole*. The phase of relaxation, during which the chambers refill with blood, is called the *diastole*.

83. Heart Sounds

Much can be learned of the condition of the heart by listening to it with a stethoscope. In the normal heart, two sounds are heard which are best described in the words "lubb-dub." The first sound is that of the closure of the valves between the atria and the ventricles and the contraction of the ventricles. The second sound is that of the closure of the pulmonary valves. In some diseases of the heart, the sounds become altered and "murmurs" may develop. By interpreting the sounds, it is possible to make a diagnosis of the diseases.

84. Pulse

Every time the heart beats, it forces blood into the arteries and causes them to dilate. Then the arteries contract as the blood moves further along in the circulatory system. This alternate dilation and contraction of the arteries which occurs with each heart beat is called the "pulse." The pulse may be felt at certain points where the arteries are close to the surface of the body. The most common location is in the wrist at the base of the thumb (radial artery). Other places where the pulse may be felt are just in front of the ear (temporal artery), at the side of the neck (carotid artery), and in the groin (femoral artery). By placing the fingers over the artery and gently pressing it, you can feel the pulsations and count them. Normally, the pulse rate is 70 to 80 per minute, but it can vary considerably, depending upon the age, sex, emotional state of the individual, and other factors. The pulse rate is faster in children than in adults. It is faster in women than in men. Excitement or exercise may cause a temporary increase in pulse rate. Irregularities in the force, rate, and rhythm of the pulse are of diagnostic importance.

85. Blood Pressure

Blood pressure is the force that blood exerts on the walls of the vessels through which it flows. All parts of the blood vascular system are under pressure. In ordinary usage, however, the term blood pressure applies to arterial pressure because this is of practical significance. When the left ventricle contracts, pressure in the arteries is at its highest and is called the *systolic pressure*. When

the ventricle relaxes (diastole), the pressure falls. This is called *diastolic pressure.* The numerical difference between systolic and diastolic pressures is called the *pulse pressure.* Measurement of blood pressure is described in paragraph 399.

86. Lymphatic System

(fig. 26)

The lymphatic system consists of *lymph*, *lymph vessels*, and *lymph nodes.* The spleen and certain other structures belong, at least in part, to the lymphatic system.

a. Tissue Fluid. Tissue fluid is the colorless fluid which fills the spaces between tissues, between the cells of organs, and between cells and connective tissue. This fluid is found in all parts of the body. It serves as a "middleman" for the exchanges between blood and cells. Food and oxygen pass through the walls of capillaries and through tissue fluid to reach cells. Wastes pass from cells through the fluid and through the walls of capillaries to be carried away by the blood. Tissue fluid is formed from plasma. Such tissue fluid is collected by the lymphatic system.

b. Lymph. Lymph is the fluid found in the lymph vessels. Lymph is similar to tissue fluid, clear and watery, derived from plasma.

c. Lymph Vessels. The lymphatic capillaries are small vessels which start as blind ducts within the tissues and remove certain materials from the cells. They unite to form larger vessels which resemble veins in structure and arrangement. The superficial vessels collect lymph from the skin and subcutaneous tissue; the deep vessels collect lymph from all other parts of the body. Valves in the lymph vessels prevent backflow. Lymph is carried from the tissues through the vessels to the *thoracic duct* which empties into a large vein, the left subclavian, at the root of the neck on the left side. A similar but less well defined vessel occupies a corresponding position on the right side and empties into the right subclavian vein.

d. Lymph Nodes. Lymph nodes lie along the course of lymph vessels. They occur in groups up to a dozen or more (fig. 26). Although variable in size they are usually small oval bodies and are composed of lymphoid tissue. Lymph nodes act as filters for removal of infective organisms from the lymph stream.

e. Infection and the Lymphatic System. Lymph vessels and lymph nodes often become inflamed as the result of infection. An infection in the hand may cause inflammation of the lymph vessels as high as the axilla (armpit). Sore throat may cause lymph nodes in the neck to become inflamed and swollen.

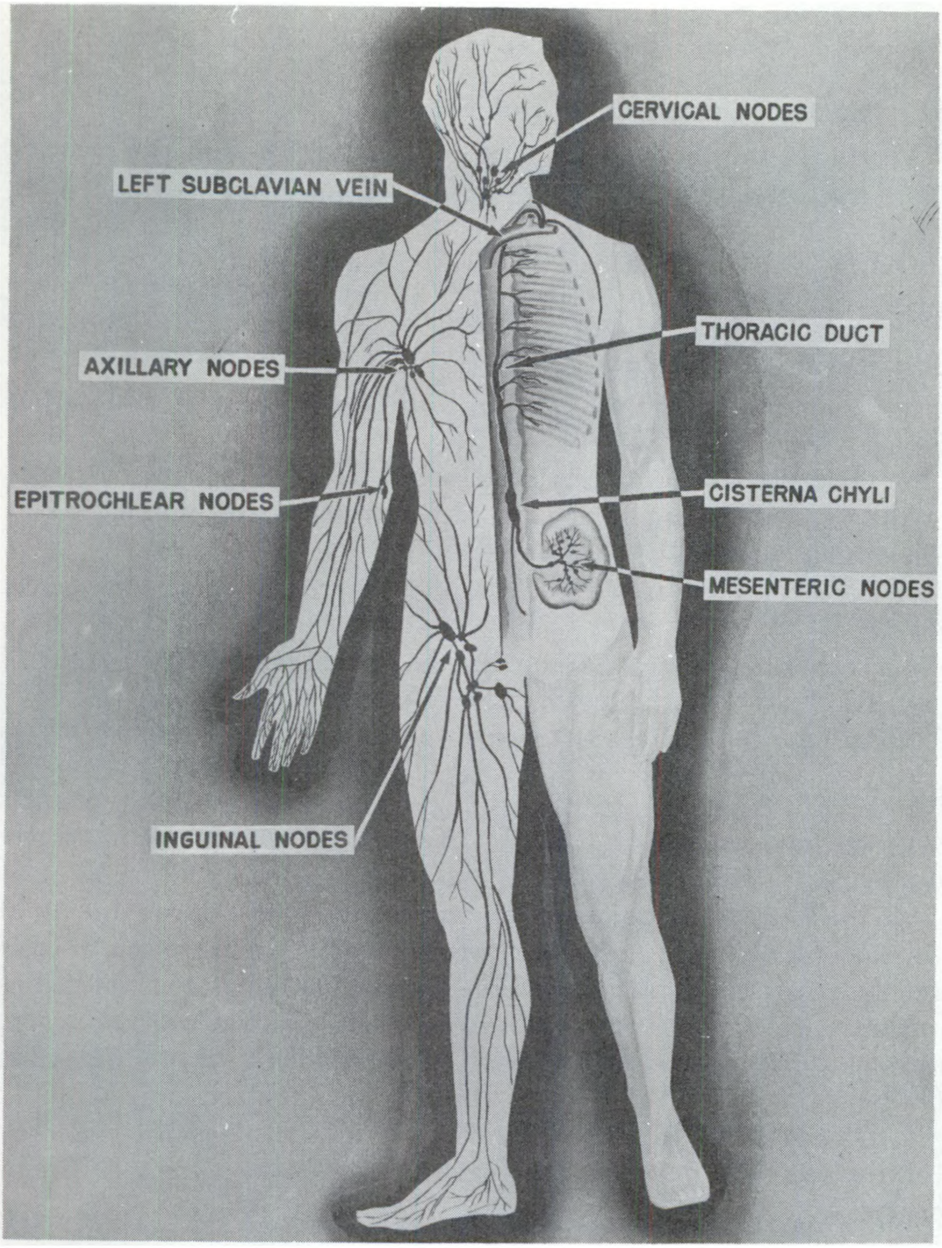


Figure 26. Distribution of principal lymph nodes and their vessels.

f. Spleen. The spleen is the largest collection of lymphoid tissue in the body. It is located high in the abdominal cavity on the left side, below the diaphragm and behind the stomach. It is somewhat long and ovoid (egg-shaped). Although the spleen can be removed without noticeable harmful effects, it has useful functions. It acts as a reservoir for red blood cells and can regulate the number in circulation.

Section VI. THE BLOOD

87. Physical Characteristics of Blood

The blood is a red, sticky fluid circulating through the arteries, capillaries, and veins. It varies in color from bright red or scarlet, when it flows from arteries, to dark red, when it flows from veins. Blood is salty to the taste. The average adult man has five to six quarts of blood.

88. Functions of Blood

a. To carry oxygen from the lungs to the tissue cells, and carbon dioxide from the cells to the lungs.

b. To carry food materials, absorbed from the digestive tract, to the tissue cells and to remove waste products for elimination by the excretory organs.

c. To carry hormones from the ductless glands to the tissues of the body.

d. To help regulate and equalize body temperature.

e. To protect the body against infection.

f. To maintain the fluid balance in the body.

89. Composition of Blood

Blood is composed of formed elements (cells or *corpuscles*) suspended in a fluid (*plasma*).

a. Plasma. Plasma makes up more than one-half of the total volume of blood. It is the carrier for blood cells and carbon dioxide and other dissolved wastes. It also brings hormones and antibodies to the tissues. Other components of plasma include water, oxygen, nitrogen, fat, carbohydrates, and proteins. One of the latter is fibrinogen, a protein that helps the clotting of blood.

b. Blood Cells. The cellular elements in the blood are *red cells* (erythrocytes), *white cells* (leukocytes), and *blood platelets* (thrombocytes).

90. Red Cells (Erythrocytes)

a. The red cells are disc-shaped and do not have a nucleus. They number about 5,000,000 per cubic millimeter of blood in the average normal adult. Red cells are formed, in the adult, by the red bone marrow. Millions of red cells are thought to be destroyed daily either in the liver, the spleen, the lymph nodes, or in the vascular system itself. In a healthy person, the rate of destruction is equaled by the rate of production so that the *red count* of about 5,000,000 cells per cubic millimeter remains constant.

b. Red cells contain a pigment called *hemoglobin* which gives the cells their color. Hemoglobin has the power to combine with oxygen, carrying it from the lungs to the tissue cells. It assists in

transporting carbon dioxide from the cells to the lungs. This transportation of gases is the principal function of red cells. Reduction in the number of red cells or in their hemoglobin content causes the condition known as *anemia*.

91. White Cells (Leukocytes)

a. White cells, or leukocytes, have a nucleus. They are colorless and variable in size and shape. The average number in the adult is 5,000 to 10,000 per cubic millimeter of blood.

b. The function of white cells is primarily one of protection. They can ingest and destroy foreign particles (such as bacteria) in the blood and tissues. This function is called *phagocytosis* and the white cells performing it are called *phagocytes*. White cells are capable of ameboid movement; that is, they can chase a microscopic organism and engulf it. They can pass through the walls of capillaries into surrounding tissues. This ability to enter tissue makes them very useful in fighting infection. Thus, an area of infection is characterized by a great increase of white cells which gather about the site and try to destroy the bacteria. An example of this is seen in an ordinary boil. The pus contained in a boil is made up largely of white cells with bacteria and dissolved tissue. Many of the white cells are killed in their struggle with the invading bacteria.

c. In various diseases, the number of white cells in the blood stream may increase considerably, especially in acute infections. This increase is called *leukocytosis*. Two common conditions where there is a leukocytosis are pneumonia and appendicitis. In certain other conditions, such as malaria, typhoid, and poisoning, the number of white cells may fall below normal. A subnormal white count is known as *leukopenia*.

92. Blood Platelets

Blood platelets are round bodies in the blood that have no nucleus. They are smaller than red blood cells and number about 300,000 per cubic millimeter of blood. Their main function is to aid in the coagulation of blood.

93. Coagulation of Blood

a. Blood coagulation, or clotting, is the body's major method of preventing excessive loss of blood when the walls of the vessel are broken or cut open. When undisturbed, blood circulates in its vascular system without showing a tendency to clot. However, when blood leaves its natural environment certain physical and chemical factors are changed and it begins to clot almost at once. At first the clot is soft and jelly-like but it soon becomes firm and acts as a plug, preventing the further escape of blood.

b. Ordinarily, blood begins clotting almost as soon as it is shed. Usually it takes 3 to 5 minutes for blood to clot. When blood is slow to clot, as in the disease called *hemophilia*, clotting can be promoted by use of drugs known as *coagulants*. Sometimes it is necessary to hold back the clotting process. This is done with drugs called *anticoagulants*.

94. Hemorrhage

Hemorrhage, or bleeding, is the escape of blood from vessels due to a break in their walls. It may be caused by wounding or by disease. Whatever its cause, hemorrhage can be a serious threat to life and calls for prompt control. Hemorrhage can occur either externally or internally. *External hemorrhage* is bleeding that can be seen, such as bleeding from a wound. In external hemorrhage, blood escapes to the outside and spills onto the surface of some part of the body. *Internal hemorrhage* happens inside the body, spilling blood into tissues, a body cavity, or an organ. It can occur without any blood being seen outside the body. Bleeding in some internal areas is evident, however, when blood is vomited, coughed up, or excreted. For example, if bleeding is in the stomach, blood is usually vomited. If bleeding is in the lungs, blood may be coughed up. Bleeding in the intestinal tract may be detected by blood excreted with the feces.

a. Effects. The effects of hemorrhage depend on the amount of blood lost and the rate of loss. The general effects are that blood pressure drops and breathing and pulse rates become rapid. When blood is lost rapidly, as in bleeding from an artery, blood pressure may drop suddenly. If only small vessels are injured and bleeding is slow, a large amount of blood may be lost without immediate drop in blood pressure.

b. Natural Measures to Control Hemorrhage. When a blood vessel is opened, the body reacts with measures to check bleeding. One of these protective measures is the clotting of blood (par. 93). Another is the retraction of constriction of vessels. Muscle in injured blood vessels contracts, pulling the damaged vessel back into the tissues and tending to close the leak. A third protective measure is the reduction of blood pressure. This slows the flow of blood into injured vessels, thus aiding the clotting process and reducing the blood loss. As a rule, these natural responses must be helped by artificial measures for controlling hemorrhage and for restoring the blood.

95. Transfusion and Blood Types

a. Transfusion. Generally, the term transfusion is used to mean the transfer of whole blood from one individual (donor) into another (recipient). Blood transfusion is a form of replacement

therapy used when a patient lacks blood as the result of hemorrhage, shock, burn, or disease. Procedures for carrying out transfusions are described in paragraphs 482 to 484.

b. Blood Types. All human bloods may be divided into four main types or groups—O, A, B, AB. This system of typing is used to prevent incompatible blood transfusion, which causes serious reactions and sometimes death of the patient. Certain types of blood are incompatible or not suited to each other if combined. Two bloods are said to be "incompatible" when the plasma or serum of one blood causes clumping of the cells of the other. Two bloods are said to be "compatible" and safe for transfusion if the cells of each can be suspended in the plasma or serum of the other without clumping. Table I shows compatibilities and incompatibilities.

Table I. Blood Types

Donor	Recipient			
	O	A	B	AB
O	−	−	−	−
A	+	−	+	−
B	+	+	−	−
AB	+	+	+	−

− = Compatibility. + = Incompatibility.

c. Importance of Blood Types. From table I it is evident that if the donor's blood is type "O" it is compatible with all types of recipient blood or, in other words, type "O" is the universal donor. If the recipient's blood is type "AB", it is compatible with all types of donor blood or, in other words, type "AB" is the universal recipient. When a transfusion is given, the blood type of both donor and recipient should be identical, and their compatibility must be proved by a cross-matching test. However, when blood of the same type is not available and death may result if transfusion is delayed, a type "O" donor (universal donor) may be used *if* the cross-matching is satisfactory. Also, if the recipient is type "AB" any blood may be transfused *if* the cross-matching demonstrates compatibility.

Section VII. RESPIRATORY SYSTEM

96. Introduction

a. The cells of the body require a constant supply of oxygen to carry on the chemical processes necessary to life. As a result of these processes, a waste product, carbon dioxide, is formed that must be removed from the body. Oxygen and carbon dioxide are

continually being exchanged, both between the body and the atmosphere and within the body, by the process known as respiration. The system which performs this exchange of gases is the *respiratory system.*

b. The respiratory system consists of the *lungs* and a series of air passages that connect the lungs to the outside atmosphere. The organs serving as air passages are the *nose*, the *pharynx*, the *larynx*, the *trachea*, and the *bronchi.* They carry air into the depths of the lungs and end there in thin-walled sacs, the *alveoli*, where carbon dioxide is exchanged for oxygen.

97. Structure and Function of the Respiratory System

a. Nose. The nose consists of two portions, one external and the other internal (nasal cavity). The external nose is a triangular framework of bone and cartilage covered by skin. On its under surface are the *nostrils*, the two external openings of the nasal cavity. The *nasal cavity* is divided in two by the nasal septum and is separated from the mouth by the palate. Inhaled air is warmed, moistened, and filtered by the nasal cavity. The filtering is done by cilia of the mucous membrane lining the nasal passages. Cilia are numerous, long, microscopic processes which beat or wave together and cause movement of materials across the surface and out of the body. Ciliary movement is important in draining the sinuses.

b. Air Sinuses. Air spaces in several bones of the face and head open into the nasal cavity. These *air sinuses* (fig. 27) take the name of the bone in which they are found. The sinuses lighten the weight of the skull. They are lined with mucous membrane continuous with that lining the nasal cavity.

c. Pharynx. The pharynx, or throat, connects the nose and mouth with the lower air passages and esophagus (fig. 27). It is divided into three parts: the *Nasopharynx*, the *oropharynx*, and the *laryngopharynx.* It is continued as the esophagus. Both air and food pass through the pharynx. It carries air from the nose to the larynx, food from the mouth to the esophagus. The walls of the pharynx contain masses of lymphoid tissues called the *adenoids* and *tonsils.*

d. Larynx. The larynx, or voice box, connects the pharynx with the trachea (fig. 27). It is located in the upper and anterior (front) part of the neck. The larynx is shaped like a triangular box. It is made of nine cartilages joined by ligaments and controlled by skeletal muscles. The *thyroid* cartilage is the largest. It forms the landmark in the neck called "Adam's apple." Another of the cartilages is the *epiglottis.* During swallowing, the epiglottis closes the larynx, the soft palate closes the nasal cavity, and the lips close the mouth. Thus food is forced into the only remaining opening, the esophagus or gullet. Except during swallowing or when the

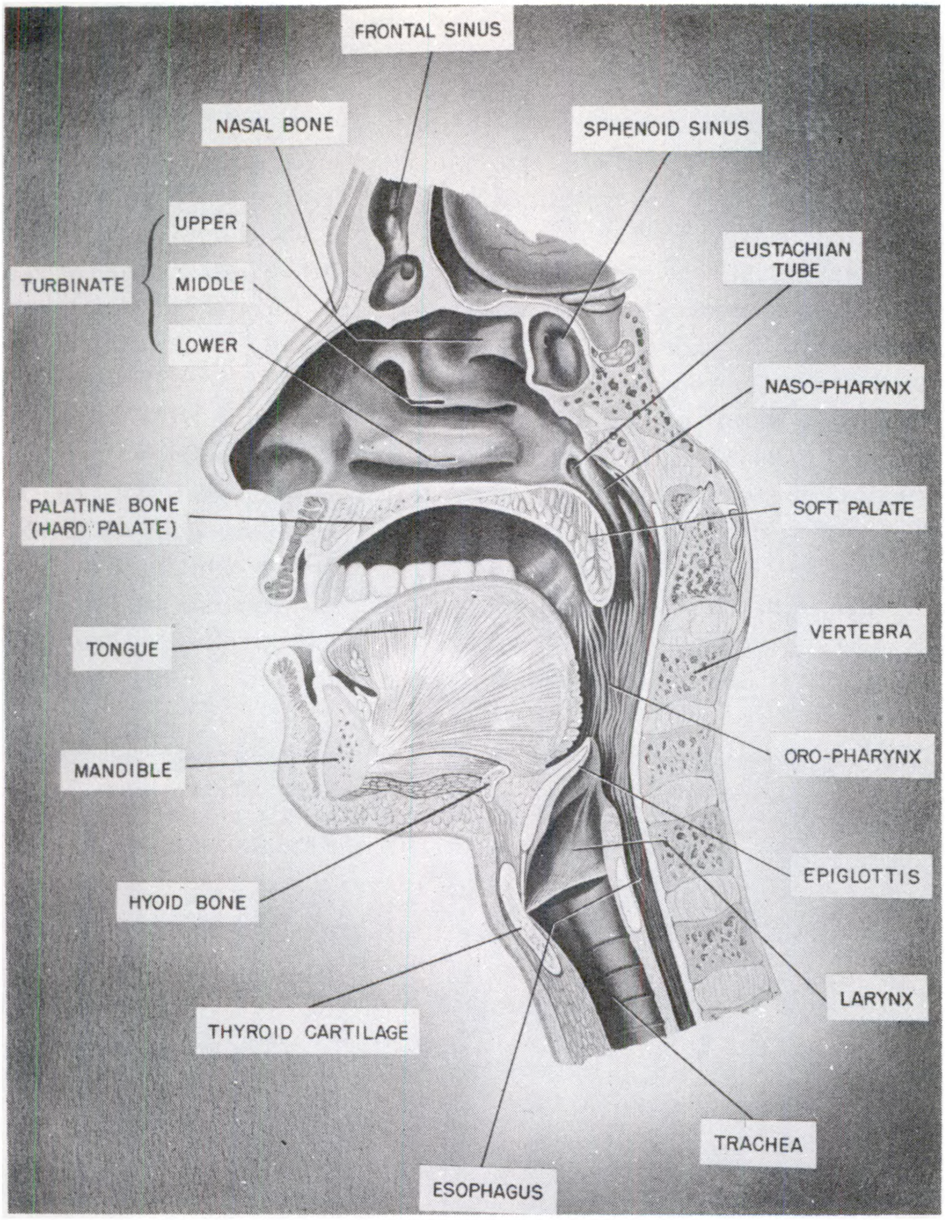


Figure 27. Upper respiratory tract.

throat is voluntarily closed, the air passages are wide open and air is free to pass from the mouth and nose into the lungs. Two membranous bands in the wall of the larynx are called *vocal cords.* Vibration of the vocal cords produce sounds.

e. Trachea. The trachea, or windpipe, is a tube held open by cartilaginous rings. It carries air from the larynx to the bronchi (fig. 28). The trachea is lined with cilia and mucous glands whose secretions provide a sticky film to keep dust and dirt out of the lungs.

f. Bronchi. The trachea divides to form the two bronchi. One bronchus enters each lung and there divides into many small air passages, called *bronchioles* or *bronchial* tubes, which lead air into the final air spaces within the lungs.

g. Lungs (fig. 28). The two lungs are the essential organs of respiration. They are contained in the chest cavity where they are separated by the mediastinum (par. 57*c*). The lungs are divided into lobes, each lobe containing many tiny air spaces called *alveoli.* Each lung is encased by a membranous sac formed of two layers of serous membranes called the *pleurae* (or singly, *pleura*). One layer covers the lungs, the other lines the chest cavity. If air enters the pleural sac it expands to form a large cavity and the lung collapses (fig. 95). This condition of air in the chest outside the lungs is called *pneumothorax.* If air can move through a hole into the chest, it is called *open pneumothorax*, a life-endangering condition. An open pneumothorax can result from a bullet wound, stab wound, or other injury that makes a hole in the chest. Such a wound must be *closed quickly* to relieve respiratory distress and to keep the patient alive.

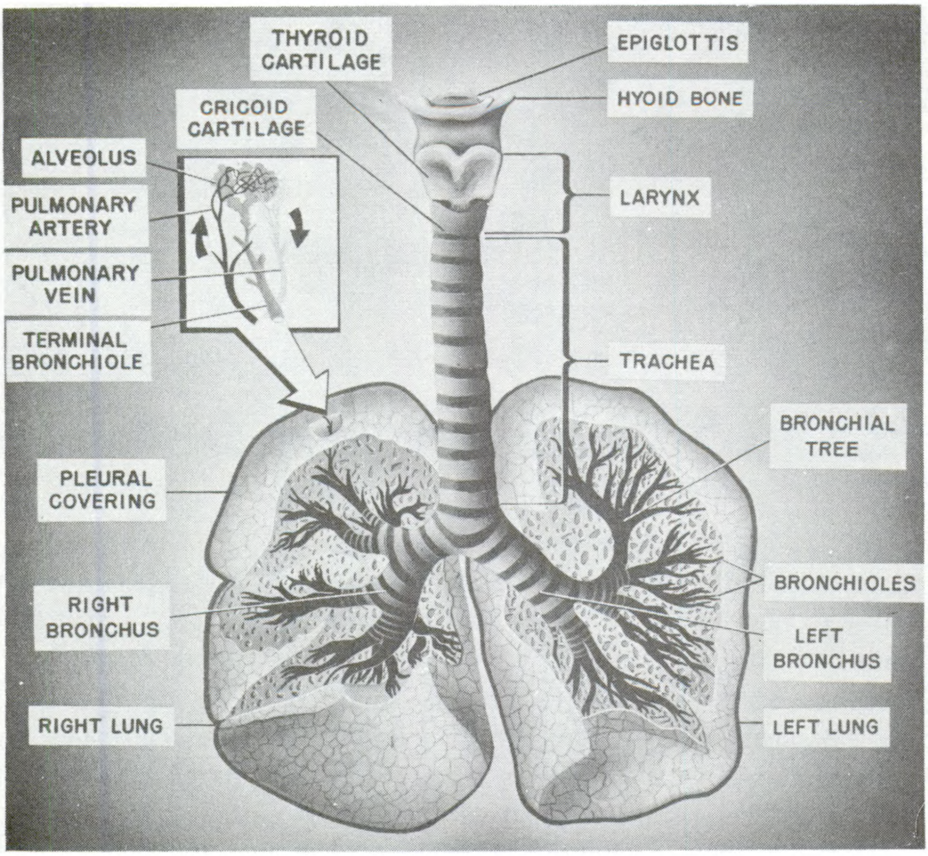


Figure 28. Lungs and air passages.

98. Physiological Process of Respiration

The walls of the alveoli are very thin and it is here that oxygen passes into the bloodstream and carbon dioxide is taken from it. This exchange of oxygen and carbon dioxide in the lungs is called *external respiration.* The oxygen which enters the blood is carried by the red blood cells in chemical combination with hemoglobin. The blood, oxygenated in the lungs, returns to the heart, then is pumped through the arteries to the capillaries. Here oxygen from the blood passes to the tissue cells and carbon dioxide from the cells passes into the blood to be carried back by the veins to the heart. The exchange of gases between the capillary blood and the tissue cells is called *internal respiration.*

99. Mechanical Process of Respiration

The act of breathing, the cycle of inspiration and expiration, is repeated about 16 to 20 times per minute in an adult at rest. Breathing is regulated primarily by a *respiratory center* in the brain. The respiratory center is sensitive to changes in blood composition, temperature, and pressure, and adjusts breathing according to the body's needs.

a. Inspiration. This is an active movement. The diaphragm, the large, dome-shaped muscle forming the floor of the thoracic cavity, contracts, flattening its domed upper surface and increasing the size of the cavity. At about the same time, muscles attached to the ribs contract to elevate and spread the ribs. This further increases the size of the cavity. Air rushes into the lungs and they expand, filling the enlarged cavity.

b. Expiration. At rest, during quiet breathing, this is a passive movement. The diaphragm relaxes and moves upward. Muscles attached to the ribs relax, permitting the chest to flatten. These actions reduce the size of the thoracic cavity, allowing the elastic recoil of the stretched lungs to drive out the air. More air can be expelled from the lungs by *forced expiration.* This is done by contraction of the abdominal muscles, forcing the diaphragm upward, and the muscles attached to the ribs, flattening the chest to compress the lungs and drive out the air. When breathing becomes forced, as with exercise, expiration also becomes active.

c. Volume. About 500 cubic centimeters (1 pint) of air are inhaled and exhaled during normal respiration. By deep inspiration it is possible to inhale an additional 1,500 cc.

d. Sounds. Sounds caused by air moving in the lungs change with some diseases. These changes, heard with a stethoscope, assist in diagnosis of diseases of the lungs such as pneumonia or tuberculosis.

Section VIII. DIGESTIVE SYSTEM

100. Description

a. The digestive system is made up of the *alimentary tract*, and the accessory organs of digestion (salivary glands, liver, pancreas, and gall bladder). Its main functions are to ingest and carry food so that digestion and absorption can occur, and to eliminate unused waste material. The products of the accessory organs help to prepare food for its absorption and use (metabolism) by the tissues of the body.

b. Digestion consists of two processes, one mechanical and the other chemical. The mechanical part of digestion includes chewing, swallowing, peristalsis, and defecation. The chemical part of digestion consists of breaking foodstuffs into simple components which can be absorbed and used by the body. In this process, foodstuffs are broken down by *enzymes*, or digestive juices, formed by digestive glands (table II). Carbohydrates are broken into simple sugar (glucose). Fats are changed into fatty acids. Proteins are converted to amino acids.

*Table II. Digestive Juices and Their Action**

Digestive juice	Source	Acts upon—	To produce—
Ptyalin	Salivary gland	Starch	Complex sugar (maltose).
Maltase	do	Complex sugar (maltose).	*Simple sugar* (glucose).
Pepsin	Lining of the stomach.	Protein	Split proteins (proteose and peptone).
Rennin	do	Milk	Coagulate milk.
Gastric lipase	do	Fat	Small fat particles.
Hydrochloric acid	do	Keeps stomach content acid.	To facilitate the action of other juices.
Amylase	Pancreas	Starch	Complex sugar (maltose).
Trypsin	do	Split proteins (proteose and peptone).	Peptids and polypeptids.
Erepsin	do	Peptids	Separate *amino acids*.
Steapsin	do	Fat	Fatty acids and glycerin.
Bile	Liver	do	Emulsified fat.
Invertase	Lining of the duodenum.	Complex sugar (sucrose and lactose).	*Simple sugars* (fructose, galactose, and glucose).
Erepsin	do	Peptids	Separate *amino acids*.

*The names of foods as they are absorbed by the intestinal tract are shown in italics.

101. Structure of Digestive System

a. The alimentary canal is about 28 feet long, extending from the lips to the anus, and is divided as follows (fig. 29):

Mouth cavity:	Stomach
Teeth	Small intestine
Tongue	Large intestine
Pharynx	Rectum
Esophagus	Anus

b. The accessory organs that aid the process of digestion are: the salivary glands, pancreas, liver, gall bladder, and intestinal glands.

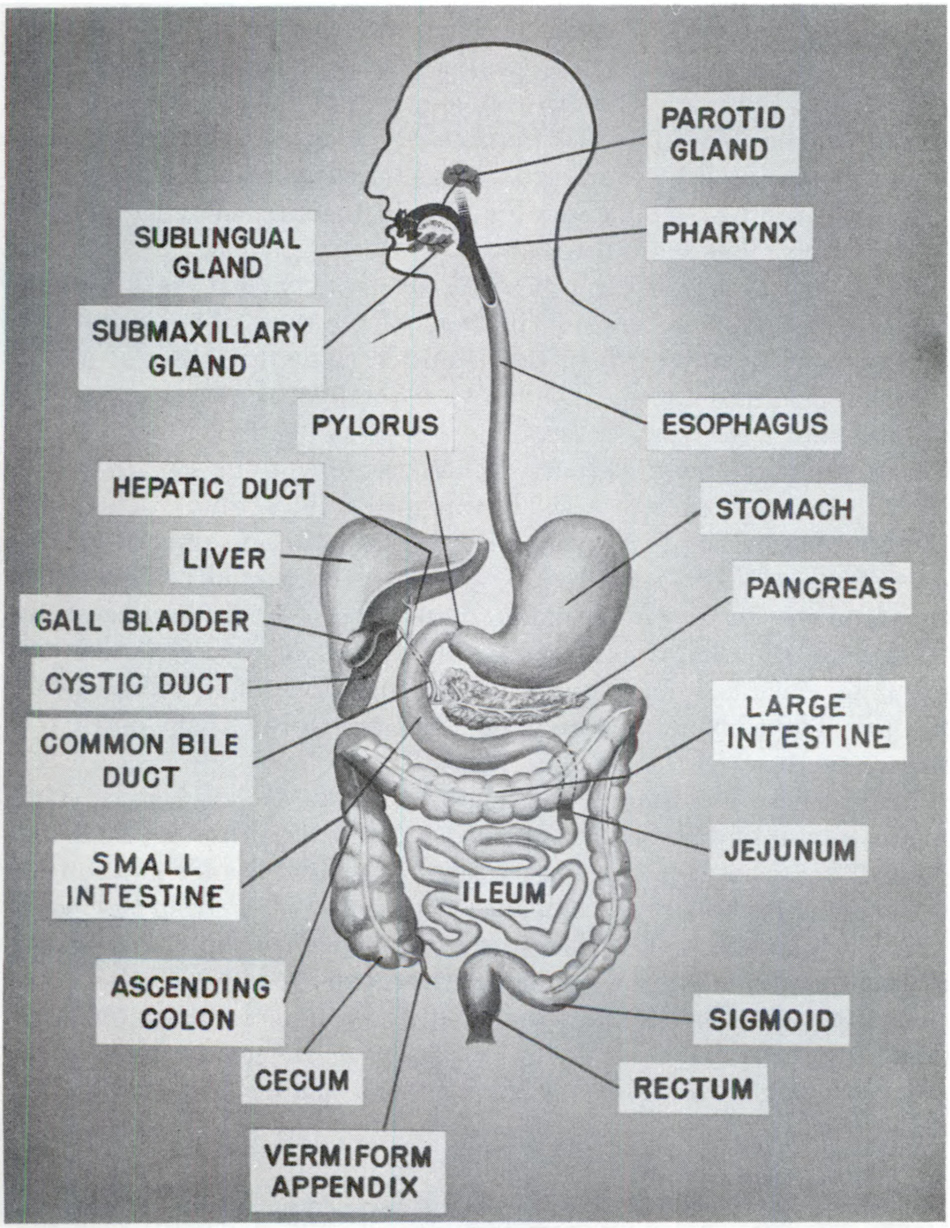


Figure 29. Digestive system.

102. The Mouth

The mouth, or *oral cavity*, is the beginning of the digestive tube. Here food taken into the body is broken into small particles and mixed with saliva so that it can be swallowed.

a. Teeth. A person develops two sets of teeth during his life, a temporary set and a permanent set. The temporary set has 20 teeth, often called *milk* or *baby* teeth. These teeth erupt during the first 3 years of life. They are replaced during the period between the 6th and 14th years by permanent teeth. There are 32 permanent teeth in the normal mouth; four incisors, two cuspids, four bicuspids, and six molars in each jaw. Each tooth is divided into two main parts: the *crown*, that part which is visible above the gums; and the *root*, that part which is not visible and which is embedded in the bony structure of the jaw. The primary function of the teeth is the chewing or mastication of food. Secondarily, the teeth help to modify sound as produced by the larynx and as used in forming words.

b. Salivary Glands. These glands are the first accessory organs of digestion. There are three pairs of salivary glands. They secrete saliva into the mouth through small ducts. One pair is located at the side of the face below and in front of the ears. The second pair of glands lie on either side of the mandible. The third pair of glands lie just below the mucous membrane in the floor of the mouth. The flow of saliva is begun in several ways. Placing food in the mouth affects the nerve endings there. These nerve endings stimulate cells of the glands to excrete a small amount of thick fluid. The sight, thought or smell of food also activates the brain and induces a large flow of saliva. About 1,500 cc. of saliva is secreted daily. The saliva moistens the food, which makes chewing easier. It lubricates the food mass to aid in the act of swallowing. Saliva contains two enzymes, chemical ferments which change foods into simpler elements. The enzymes act upon starches and break them down into sugars.

c. Tongue. The tongue is a muscular organ attached at the back of the mouth and projecting upward into the oral cavity. It is concerned in taste, speech, mastication, salivation, and swallowing. After food has been masticated, the tongue propels it from the mouth into the pharynx. This is the first stage of swallowing. Mucus secreted by glands in the tongue lubricates the food and makes swallowing easier. *Taste buds* situated in the tongue make it the principal organ of the sense of taste. Stimulation of the taste buds causes secretion of gastric juices needed for the breaking down of food in the stomach.

103. Pharynx

The pharynx is a muscular canal which leads from the nose and mouth to the esophagus. The passage of food from the pharynx

into the esophagus is the second stage of swallowing. When food is being swallowed, the larynx is closed off from the pharynx to keep food from getting into the respiratory tract.

104. Esophagus

The esophagus is a muscular tube about 10 inches long, lined with a mucous membrane. It leads from the pharynx through the chest to the upper end of the stomach. Its function is to complete the act of swallowing. The involuntary movement of material down the esophagus is carried out by the process known as *peristalsis*, which is the wavelike action produced by contraction of the muscular wall. This is the method by which food is moved throughout the alimentary canal.

105. Stomach

The stomach is a muscular bag which lies in the upper abdomen on the left side, just below the diaphragm, and extends to the right of the midline. The upper portion, where the esophagus enters, is known as the *cardiac end.* The lower end, where the stomach opens into the small intestine, is called the *pyloric region.* At the junction between the stomach and small intestine is a muscular ring which acts as a valve, opening and closing to regulate the passage of food out of the stomach. The stomach has two important functions in the digestive process.

a. It acts as a storehouse for food. The stomach can expand and contract as the need arises. In this way, the stomach can receive fairly large quantities of food, then release it in small amounts when the rest of the digestive system can receive it.

b. The stomach helps in the chemical breakdown of food. Its walls are lined with small glands which secrete gastric juice and hydrochloric acid. Gastric juice contains two enzymes. The enzymes act on proteins and break them into simpler forms. Hydrochloric acid kills bacteria which enter the stomach and helps to regulate the opening and closing of the pyloric valve. Food leaves the stomach in a semiliquid form. At this point it is about half digested.

106. Peritoneum

The *peritoneum* is the serous membrane which lines the abdominal cavity. The peritoneum covers the viscera (abdominal organs) and secretes a serous fluid which prevents friction between adjacent organs.

107. Small Intestine

The small intestine is a tube about 22 feet long. The intestine is attached to the margin of a thin band of tissue called the *mesentery.*

The mesentery supports the intestine, and the vessels which carry blood to and from the intestine lie within this membrane. The other edge of the mesentery is drawn together like a fan; this gathered margin is attached to the rear wall of the abdomen. This arrangement permits folding and coiling of the intestine so that this long organ can be packed into a small space. The intestine is divided into three continuous parts: *duodenum*, *jejunum*, and *ileum*. It receives digestive juices from three accessory organs of digestion: the *pancreas*, *liver*, and *gall bladder*.

a. Pancreas. The pancreas is a long, tapering organ lying behind the stomach. The *head* of the gland lies in the curve of the small intestine near the pyloric valve. The *body* of the pancreas extends to the left toward the spleen. The pancreas secretes a juice which acts on all types of food. Two enzymes in pancreatic juice act on proteins. Other enzymes change starches into sugars. Another enzyme changes fats into their simplest forms. Table II lists the digestive juices and their actions. The pancreas has another important function, the production of *insulin* (par. 129).

b. Liver. The liver is the largest organ in the body. It is located in the upper part of the abdomen with its larger (right) lobe to the right of the midline. It is just under the diaphragm and above the lower end of the stomach. The liver has several important functions. First is the secretion of *bile*, which is stored in the gall bladder and discharged into the small intestine when digestion is in process. The bile contains no enzymes but it breaks up the fat particles so that enzymes can act faster. The liver performs other important functions. It is a storehouse for the sugar of the body (glycogen) and for iron and vitamin B. It plays a part in the destruction of bacteria and wornout red blood cells. Many chemicals such as posions or medicines are detoxified by the liver; others are excreted by the liver through bile ducts. The liver manufactures part of the proteins of blood plasma.

c. Gall Bladder. The gall bladder is a dark green sac, shaped like a blackjack and lodged in a hollow on the under side of the liver. Its ducts join with the duct of the liver to conduct bile to the upper end of the small intestine. The main function of the gall bladder is the storage and concentration of the bile when it is not needed for digestion.

d. Ileum. Most of the absorption of food takes place in the ileum. The walls of the ileum are covered with extremely small, finger-like structures called *villi* which provide a large surface for absorption. After food has been digested, it is absorbed into the capillaries of the villi. Then it is carried to all parts of the body by the blood and lymph.

108. Large Intestine

The large intestine is about 5 feet long. At the junction of the large and small intestine is the *cecum.* The cecum is a ~~blind~~ sac located on the lower right side of the abdomen. Attached to the lower end of the cecum is the *appendix*, a blind sac with no known function. The *colon* extends along the right side of the abdomen from the cecum up to the region of the liver. There the colon bends and is continued across the upper portion of the abdomen to the spleen. The colon bends again and goes down the left side of the abdomen. The last portion of the colon makes an S curve toward the center and rear of the abdomen and ends in the rectum. The main function of the large intestine is the recovery of water from the mass of undigested food it receives from the small intestine. As this mass passes through the colon, water is absorbed and returned to the tissues. Waste materials, or *feces*, become more solid as they are pushed along by peristaltic movements. *Constipation* is caused by delay in movement of intestinal contents and removel of too much water from them. Diarrhea results when movement of the intestinal contents is so rapid that not enough water is removed.

109. The Rectum and Anus

The rectum is about 5 inches long and follows the curve of the sacrum and coccyx until it bends back into the short anal canal. The *anus* is the external opening at the lower end of the digestive system. It is kept closed by a strong sphincter muscle. The rectum receives feces and periodically expels this material through the anus. This elimination of refuse is called *defecation.*

110. Time Required for Digestion

Within a few mintues after a meal reaches the stomach, it begins to pass through the lower valve of the stomach. After the first hour the stomach is half empty, and at the end of the sixth hour none of the meal is present in the stomach. The meal goes through the small intestine, and the first part of it reaches the cecum in 20 minutes to 2 hours. At the end of the sixth hour most of it should have passed into the colon; in 12 hours all should be in the colon. Twenty-four hours from the time when food is eaten, the meal should reach the rectum. However, part of a meal may be defecated at one time and the rest at another.

111. Absorption of Digested Food
(fig. 30)

There is very little absorption in the stomach. Most absorption takes place in the small intestine. The final products of digestion pass through the mucous membrane lining of the gastrointestinal

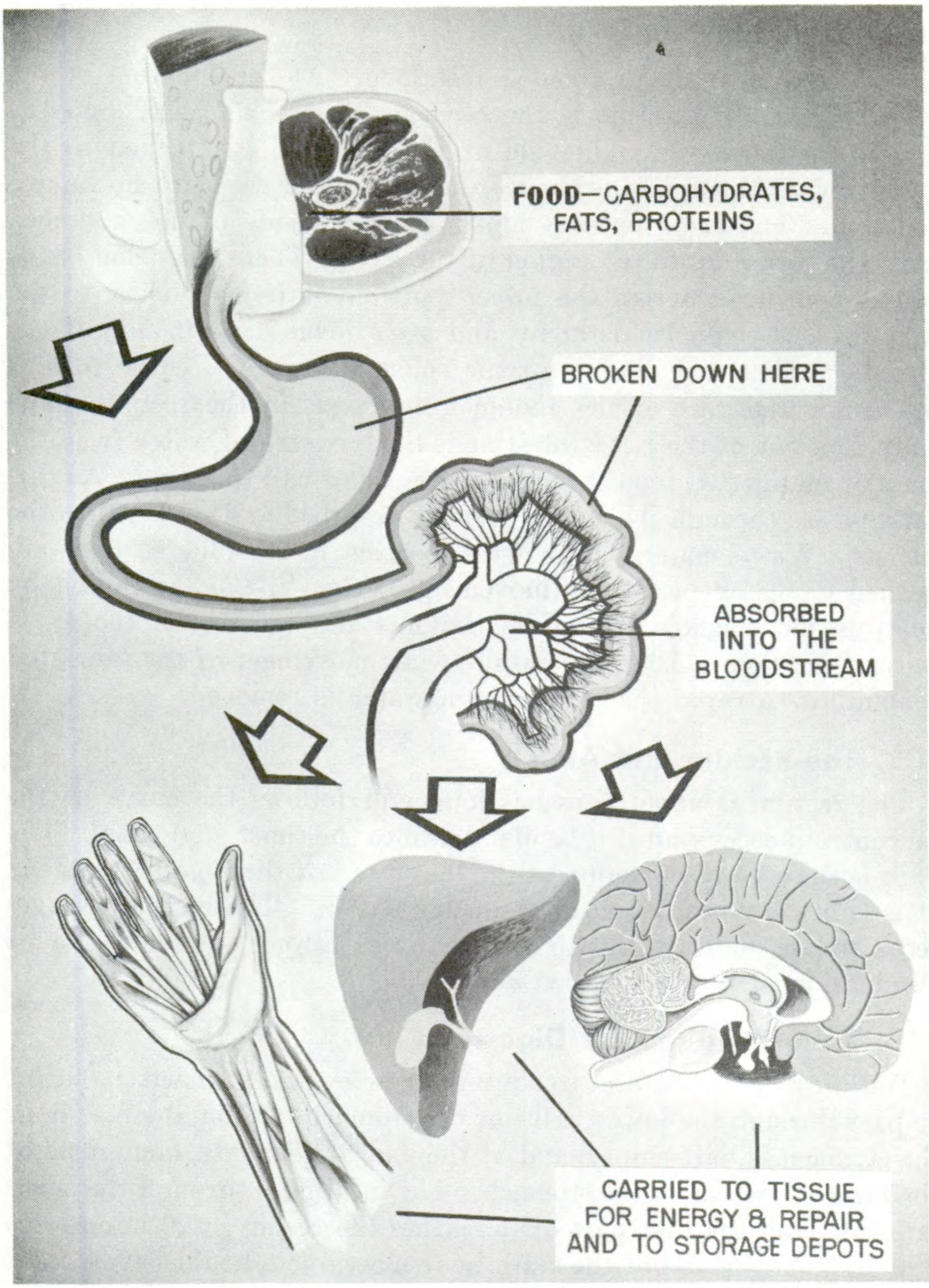


Figure 30. Assimilation of food.

tract and are carried to the liver and from there to the rest of the body. There is marked absorption of water in the large intestine. The residue is concentrated and expelled as feces.

112. Defecation

The passage of feces is called defecation. It is begun voluntarily by contraction of the abdominal muscles. At the same time, the sphincter muscles of the anus relax and there is a peristaltic contrac-

tion wave of the colon and rectum. Feces are expelled as a result of all these actions. Feces consist of undigested food residue, secretions from the digestive glands, bile, mucus, and millions of bacteria. Mucus is derived from the many mucous glands which pour secretions into the intestine. Bacteria are especially numerous in the large intestine. They act upon food material, causing putrefaction of proteins and fermentation of carbohydrates.

Section IX. UROGENITAL SYSTEM

113. Description

The urogenital system consists of the urinary organs for the production and discharge of urine and the genital organs, which are responsible for reproduction.

a. The urinary organs include two kidneys, two ureters, one urinary bladder, and one urethra.

b. The male genital organs (fig. 31) include two testes, two epididymides, two vas deferens, two ejaculatory ducts, one prostrate gland, one urethra, and one penis.

c. The female genital organs (fig. 32) include two ovaries, two Fallopian tubes, one uterus, one vagina, and the external genitalia.

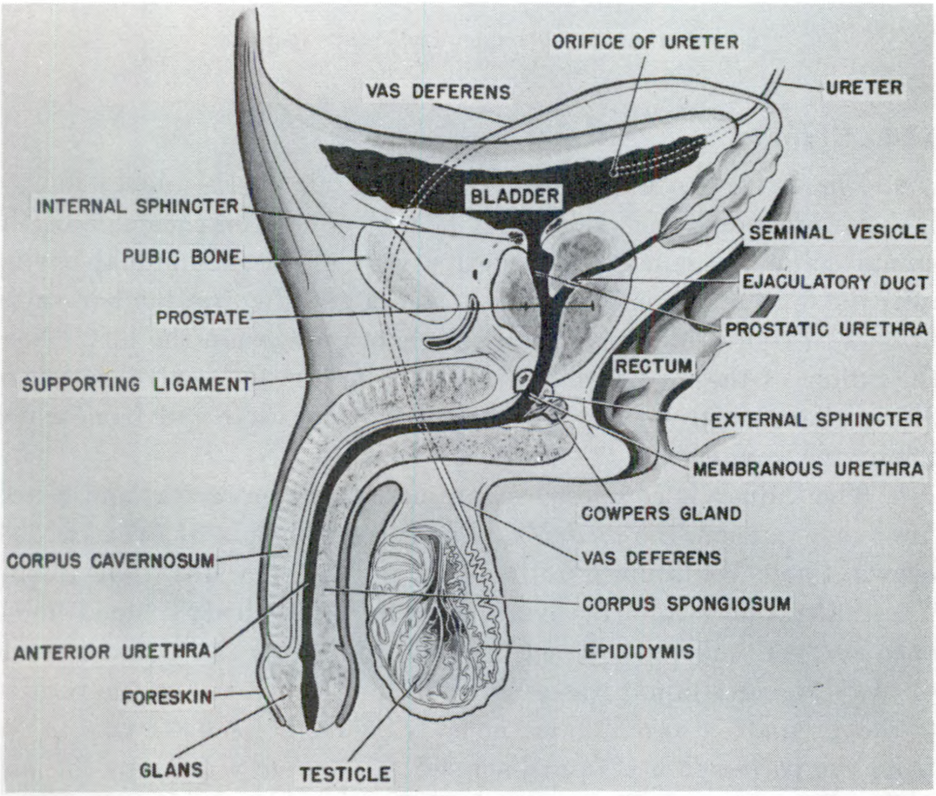


Figure 31. Male urogenital system.

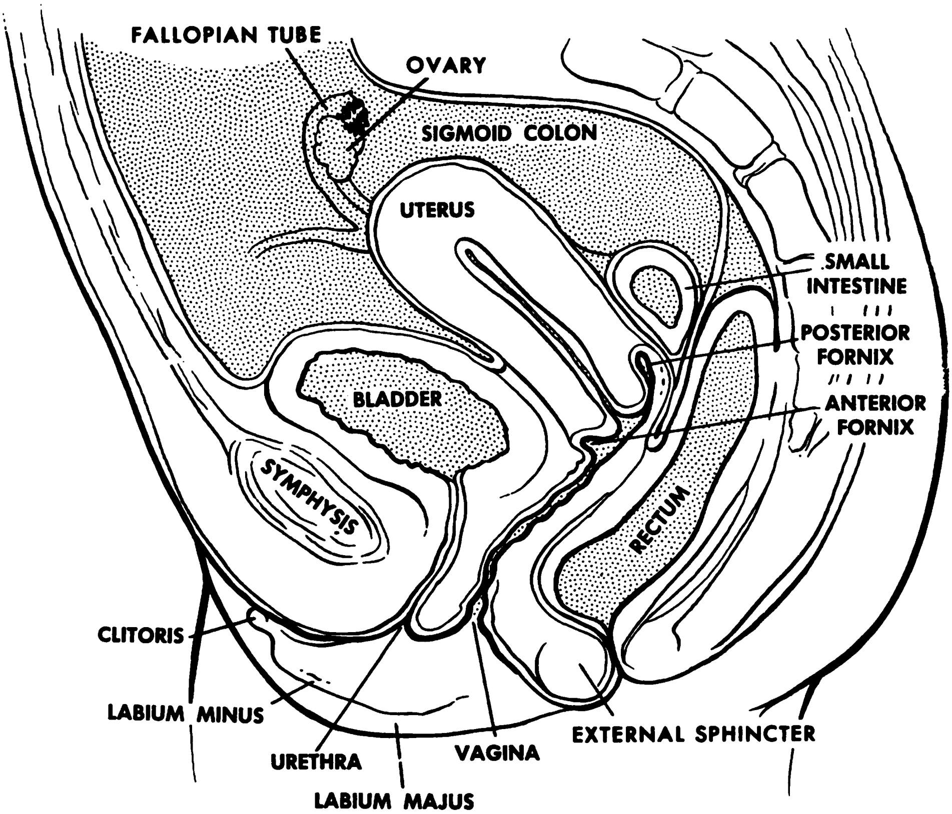


Figure 32. Female urogenital system.

114. Kidneys

a. The kidneys are bean-shaped organs, about 4½ inches long, 2 inches wide, and 1 inch thick (fig. 33). They lie on each side of the spinal column, against the posterior wall of the abdominal cavity, near the level of the last thoracic vertebra and the first lumbar vertebra. The right kidney is usually slightly lower than the left. Near the center of the medial side of each kidney is the central notch or *hilus*, where blood vessels and nerves enter and leave and from which the ureter leaves.

b. The kidney is composed of an outer shell or *cortex*, and a hollow inner portion, the *medulla.* The cortex is made of firm, reddish brown tissue containing millions of microscopic filtration plants. These filtration plants receive and filter all the body's blood about once every 12 minutes. They draw off and filter the liquid portion of blood, remove liquid wastes (urine), and return the usable portion to the circulation to maintain the body's fluid balance. Urine passes from the cortex into a funnel-shaped sac (*renal pelvis*) in the medulla. Then it passes into a continuing tube, the ureter.

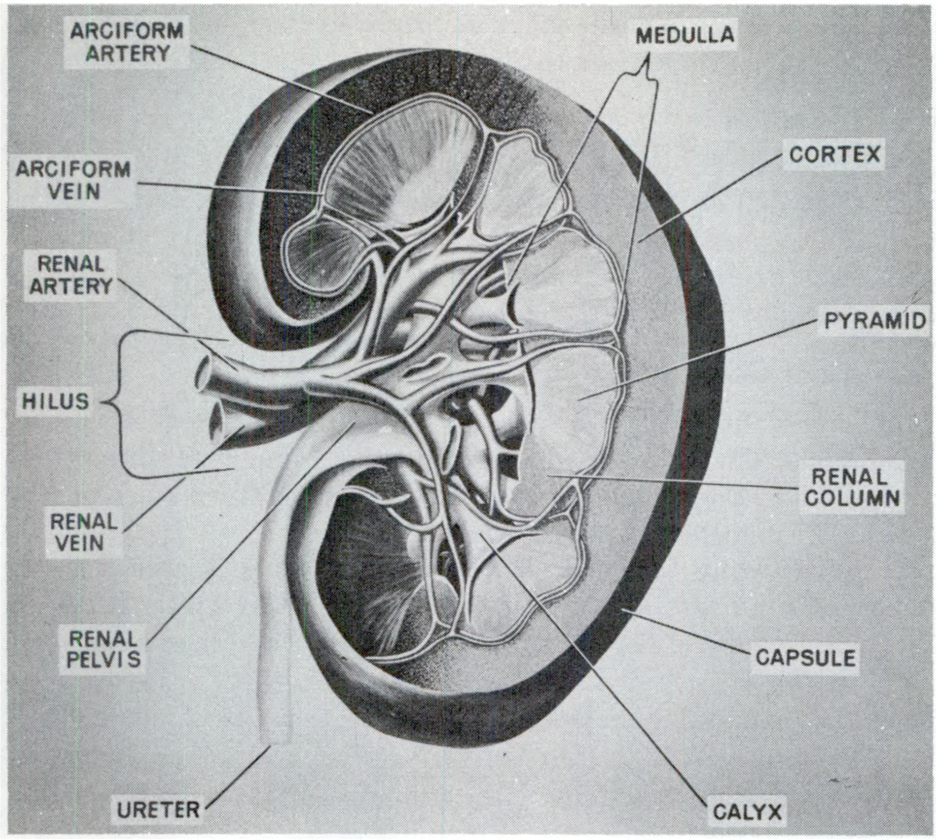


Figure 33. The kidney.

115. Ureters

The pelvis of each kidney is drained by a ureter, a muscular tube extending from the hilus to the posterior portion of the urinary bladder.

116. Urinary Bladder

The urinary bladder is a muscular sac located in the lowest part of the abdominal cavity. It stores urine. Normally it holds 100 to 300 cc. The bladder is emptied by contraction of muscles in its walls which force urine out through the urethra.

117. Urethra

The urethra is the tube that carries urine from the urinary bladder to the outside. The *male* urethra usually is about 6 inches long extending from the bladder to the end of the penis. The *female* urethra is about 1½ inches long extending from the bladder to an external opening between the clitoris and the opening of the vagina.

118. Urine

Normal urine is an aromatic, transparent or clear fluid. The color of normal urine varies from amber or pale yellow to a brownish

hue. The average quantity of urine excreted by a normal adult in 24 hours ranges from 1,500 to 2,000 cc.

119. Urination

Urination is the discharge or voiding of urine. It is done by a contraction of the bladder and relaxation of the sphincters. In the adult, the act of voiding, although dependent on involuntary reflexes, is partly under voluntary control. Voluntary contraction of abdominal muscles usually accompanies, and aids, urination.

120. Male Genital System

(figs. 31 and 34)

a. Testes. The testes, or male reproductive glands, are oval-shaped and located in the scrotum or sac. They produce *spermatozoa* (male germ cells) and the male sex hormone.

b. Epididymis. This is a mass of twisting tubes connected to the tubules of the testes at one end and the *vas deferens* at the other. The function of the epididymis is to mature the spermatozoa.

c. Vas Deferens. This is a tube which carries spermatozoa from the epididymis to the *seminal vesicle.*

d. Seminal Vesicles. The seminal vesicles are hollow structures located behind the bladder. They store spermatozoa and secrete a fluid to keep them alive.

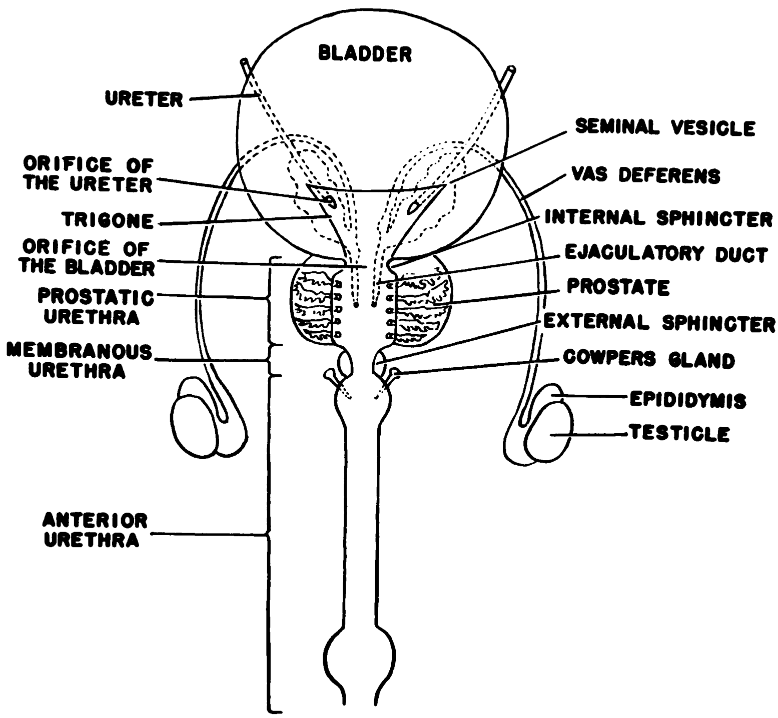


Figure 34. Diagram of male reproductive system.

e. Prostate Gland. This gland is located around the urethra at the neck of the bladder. It adds a secretion to spermatozoa as they pass through from the seminal vesicles. The secretion surrounds the spermatozoa and protects them from acids in the vagina.

f. Semen. The spermatozoa combine with secretions from the seminal vesicles and the prostate gland to form *semen* or *seminal fluid.*

121. Female Genital System

(fig. 32)

a. Ovaries. The ovaries are two small, almond-shaped glands lying on either side of the uterus. They produce the *ovum* (female reproductive cell) and secrete hormones.

b. Fallopian Tubes. These are two tubes which have free openings near the ovaries and which terminate by an opening near each upper corner of the uterus. After release by the ovaries, the ovum passes into one of the Fallopian tubes. The ovum is carried along by peristaltic action of the tube and the action of cilia, eventually reaching the uterus.

c. Uterus. The uterus, or womb, is a hollow, pear-shaped, muscular organ located in the center of the pelvis. It has two main parts: the *body* or upper part, and the *cervix*, the lower part, or neck which protrudes into the vagina.

d. Vagina. The vagina is the female organ of sexual intercourse. It is a muscular tube which is attached to the cervix and which opens anteriorly into the *vulva.*

e. Vulva. The vulva is the external genital organs of the female. It includes the *labia*, *clitoris*, and other structures. The labia are liplike folds of skin enclosing the openings of the vagina and urethra. The clitoris is an organ located at the upper meeting point of the labia.

122. Menstruation

In preparing to receive the ovum, the mucous lining (mucosa) of the uterus becomes soft and swollen and uterine blood vessels are dilated. If the ovum is not fertilized, the unneeded blood and mucosa are expelled from the uterus through the vagina. This process, called *menstruation*, begins at puberty and is repeated, except when interrupted by disease or pregnancy, about every 28 days until the age of 40 or 50 years.

Section X. ENDOCRINE SYSTEM

123. Description

a. The endocrine system is made up of the glands of internal secretion. The endocrine glands are sometimes called "ductless

glands" because they have no ducts leading from them. They pour their secretions, known as *hormones*, directly into the blood stream. Hormones produced by the endocrine glands are small in quantity but powerful in effect. Carried by the blood, these hormones reach every part of the body and influence the activities of specific organs and tissues as well as the activity of the body as a whole. Most of the hormones can be obtained by extraction from the glands of animals and some hormones can be made by artificial synthesis.

b. The endocrine glands are the thyroid, parathyroids, adrenals, pituitary, gonads (sex glands), pancreas, intestinal glands, pineal body, and thymus (fig. 35).

124. Thyroid Gland

The thyroid gland consists of two lobes and lies in the front of the neck below the larynx. It secretes a hormone called *thyroxin*, which regulates the metabolism of the body. Iodine is a major constituent of thyroxin, and lack of it results in a condition called *simple goiter.*

125. Parathyroid Glands

The parathyroid glands are small, rounded bodies, usually four in number, attached to the lobes of the thyroid gland. They secrete

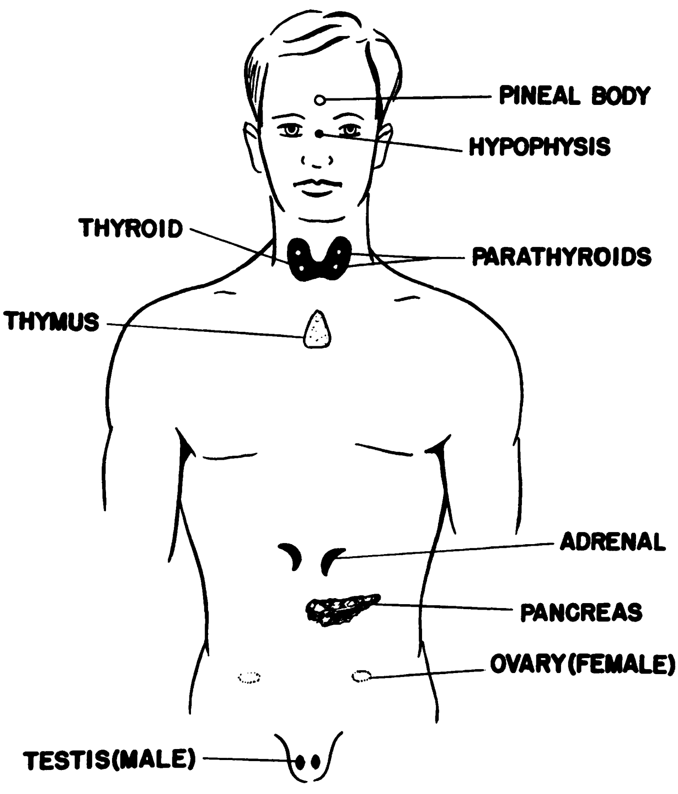


Figure 35. Endocrine glands.

a hormone, called *parathormone*, which indirectly regulates the calcium content of the blood. This is particularly important because it influences the amount of calcium in such tissue activities as bone formation, coagulation of blood, maintenance of normal muscular excitability, and milk production.

126. Adrenal Glands

The adrenal glands are two small bodies located on top of the kidneys. They consist of an inner portion called the *medulla* and an outer portion called the *cortex*. The medulla secretes the hormone called *epinephrine* (adrenalin). This hormone causes an increase in the heart rate, increase in blood pressure, and rise in the sugar content of the blood. It also assists in coagulation of blood and stimulates part of the nervous system. In states of emotional excitement and increased activity it enables the individual to mobilize the resources of the body.

127. Pituitary Gland

The pituitary gland is located at the base of the brain. It is small, about the size of a pea, and composed of two lobes. The pituitary gland is often called the "master gland" because its hormones regulate growth, reproduction, many other body processes, and activity of other endocrine glands. One lobe of the pituitary gland secretes a hormone related to bone growth. Prolonged oversecretion of this hormone may cause such abnormalities as giantism and great enlargement of feet, hands, and lower jaw. Insufficient secretion of the hormone may result in dwarfism. The second lobe secretes a hormone that helps regulate blood pressure and the amount of water excreted by the kidneys.

128. Gonads

The gonads, consisting of *ovaries* in the female and *testes* in the male, produce hormones which are important for the maintenance and function of the reproductive system. These glands become active at the start of puberty. They are responsible for the appearance of the secondary sexual characteristics: the pubic and axillary hair, the beard and the changing of the voice, and mammary development in the female.

129. Pancreas

The pancreas is a pistol-shaped organ located behind the stomach. It contains numerous clusters of specialized cells called the *Islands of Langerhans*. These cells secrete *insulin* into the blood stream. Insulin is essential for the use and storage of carbohydrates by the body. When the cells are destroyed or stop functioning, sugar absorbed from the intestine remains in the blood and is thrown off

by the kidneys. It is not used and it is not stored. This condition is called *sugar diabetes.* Insulin is given hypodermically to people with this disease as part of their treatment.

130. Intestinal Glands

The intestinal glands secrete hormones. The duodenum supplies a hormone called *secretin*, which causes the intestinal juices to flow when food reaches the intestines. The liver and spleen also are believed to supply hormones to the blood.

131. Pineal Gland and Thymus

The pineal gland is a small gland located deep within the midpart of the brain (2, fig. 36). The thymus is an organ located in front of the trachea, partly in the neck and partly in the thorax (fig. 35). Little is known of the function of these two glands.

Section XI. NERVOUS SYSTEM

132. General

a. The nervous system enables an indvidual to be aware of and to react to his environment. It coordinates the body's responses to stimuli and keeps body systems working together. The nervous system consists of nerve centers and of nerves that branch off from them and lead to tissues and organs. Most nerve centers are in the brain and spinal cord. Nerves carry impulses from tissues and organs to nerve centers and from these centers to tissues and organs.

b. Nerves are classified by function into two types, *sensory* and *motor.* Sensory nerves carry impulses from the skin and other sense organs (*receptors*) to the central nervous system (par. 133). They make the body aware of its environment. Motor nerves carry impulses from the central nervous system to muscles and glands (*effectors*). They cause the body to react to its environment.

c. For study, parts of the nervous system may be considered separately as the *central nervous system*, the *peripheral nervous system*, and the *autonomic nervous system.*

133. Central Nervous System

The central nervous system consists of the brain and the spinal cord. They communicate with other parts of the body by the nerves of the peripheral system.

a. Meninges. Three layers of protective membranes known as the *meninges* surround the brain and spinal cord. The space between the middle and inner layers contains cerebrospinal fluid.

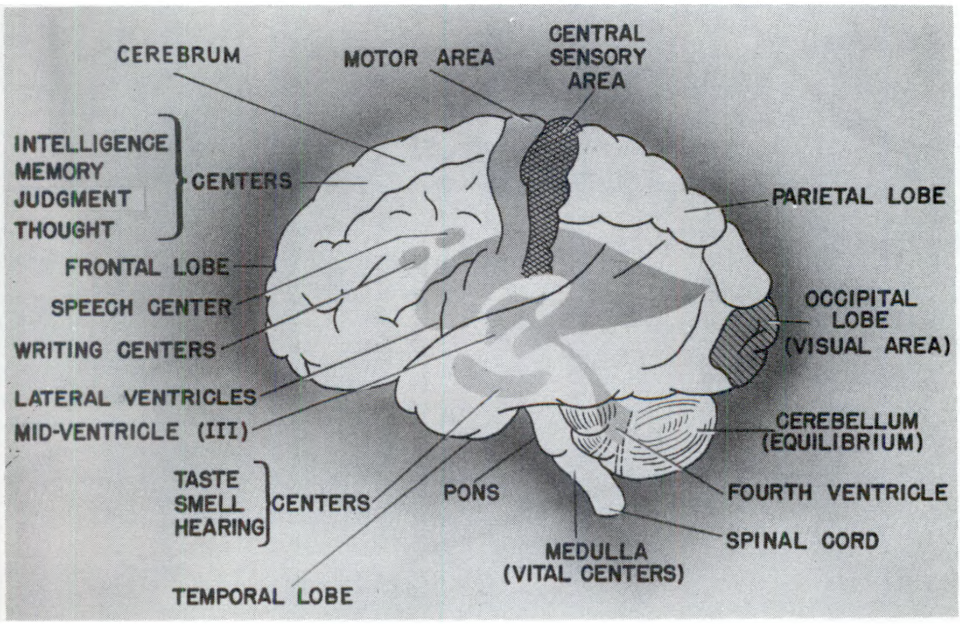
b. Brain. The brain (1, fig. 36) is inclosed in the skull, or cranium. It is the highest level of the nervous system. It coordinates activities of the entire body, carries on the learning, thinking, and

reasoning processes, and directs voluntary movements of the body. The brain is divided into four main parts: the cerebrum, cerebellum, pons, and medulla (2, fig. 36). Each part performs definite functions.

(1) *Cerebrum.* The cerebrum is made of two cerebral hemispheres. The outside surface is called the *cerebral cortex.* Certain areas of the cerebrum are localized for certain functions. In the frontal lobe are the *motor area,* which controls voluntary movements, the speech center, and the writing center. The frontal lobe is believed to be the seat of intelligence and association of ideas. In the *parietal lobe* is the general sensory area which perceives sensations of heat, cold, touch, pressure, pain, and position. The motor and sensory areas are located on the side of the brain opposite their effectors and receptors in the body. For example, if the right hand is pricked with a needle, pain is registered in the sensory area on the left side of the brain. In the *temporal lobe* are the centers for hearing and smelling. In the *occipital lobe* is the visual center.

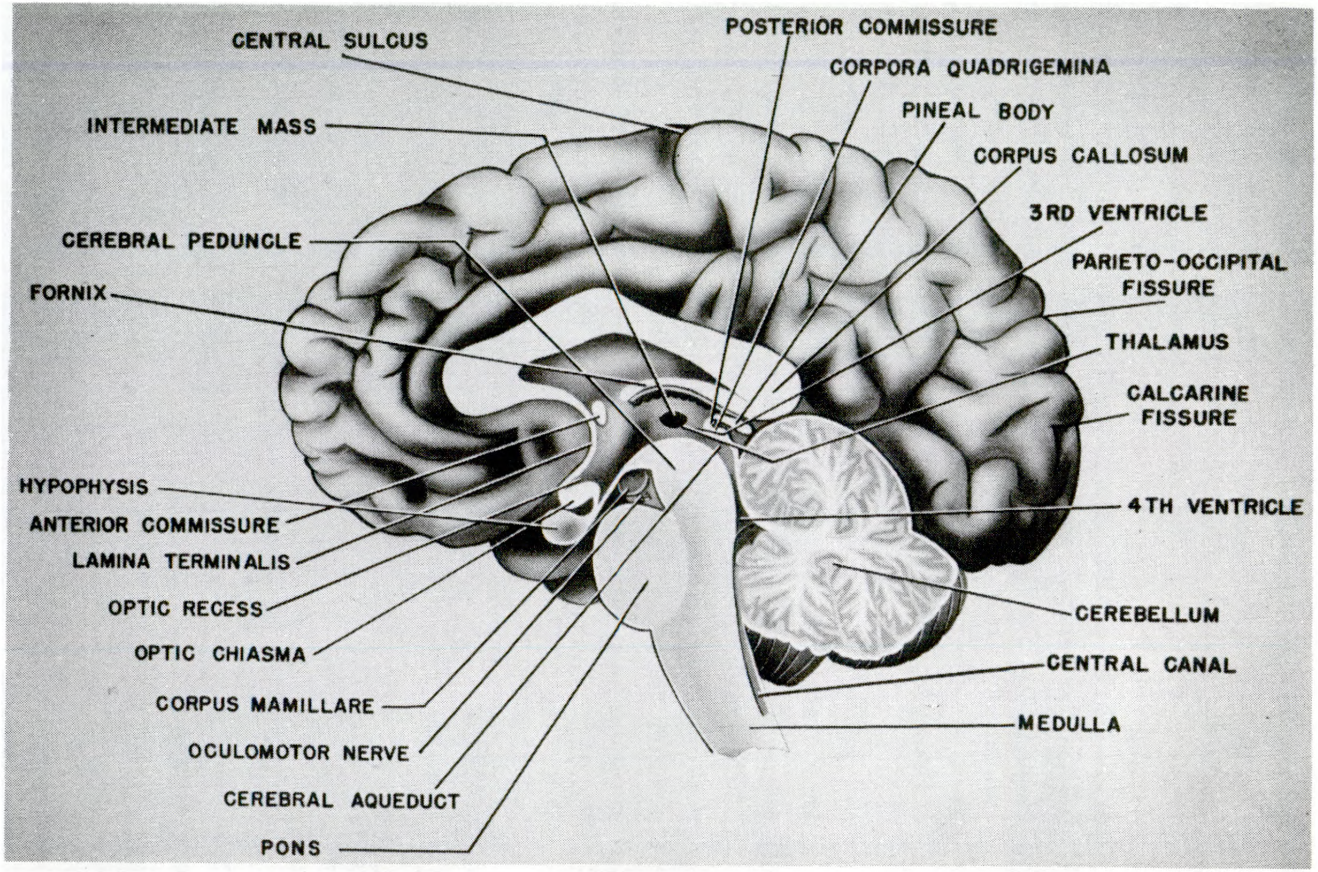
(2) *Cerebellum.* The cerebellum lies below the posterior part of the cerebrum (1 and 2, fig. 36). It serves as a coordinator of muscular activity, a regulator of muscle tone, and a center for reflex action and equilibrium.

(3) *Pons.* The pons lies in front of the cerebellum (1 and 2, fig. 36). Nerve tracts go through the pons, carrying sen-



1 Lateral view

Figure 36. The brain.



2 Sagittal section
Figure 36—**Continued.**

sory impulses to the cerebral cortex, and motor impulses away from it.

(4) *Medulla oblongota.* The medulla oblongota, or brain stem, is the lowest part of the brain, extending from the pons to the spinal cord (1 and 2, fig. 36). The medulla contains the vasomotor center, for control of blood pressure; cardio-inhibitory center, for control of heart rate through the vagus nerve; and respiratory center, for control of rate and depth of respiratory movements through vagus, phrenic, and intercostal nerves.

c. Cerebrospinal Fuid. This fluid contained in the meninges circulates over the surface of the brain and spinal cord, serving as a protective covering for the central nervous system.

d. Spinal Cord. The spinal cord is that part of the central nervous system within the cerebral column, extending from the medulla oblongota to the level of the second lumbar vertebra. The spinal cord has two separate functions: to carry fiber tracts which connect the different levels of the nervous system, and to act as reflex centers. Cutting the cord destroys the first function and releases the second function in the part of the cord below the cut. The spinal cord contains ascending and descending nerve tracts. The *ascending nerve tracts* are sensory and carry all sensations such as pain, temperature, touch, and pressure to the brain. The *descending nerve tracts* are motor and control the muscles, glands, and organs either voluntarily or involuntarily.

134. Peripheral Nervous System

The peripheral nervous system is composed of 12 pairs of *cranial nerves* and 31 pairs of *spinal nerves* stemming from the brain and spinal cord respectively. The nerve fibers carry both voluntary and involuntary impulses. Not every nerve necessarily has both types of fibers.

a. Cranial Nerves. The cranial nerves supply the organs of special senses, such as the eyes, ears, nose, and tongue, and their associated muscles. They also control muscles of the face, neck, thorax, and abdomen. The cranial nerves are voluntary except for those few involuntary fibers going to the ciliary eye muscles, salivary glands, heart, smooth muscles of the lungs, and gastrointestinal tract.

b. Spinal Nerves. Spinal nerves control skeletal muscles and some smooth muscles and glands. They also receive all sensations (such as pain, temperature, and touch) and carry these impulses to the brain and spinal cord. Figure 37 shows names and distribution of the larger nerve trunks. The spinal nerves have voluntary fibers going to all skeletal muscles of the trunk and extremities and in-

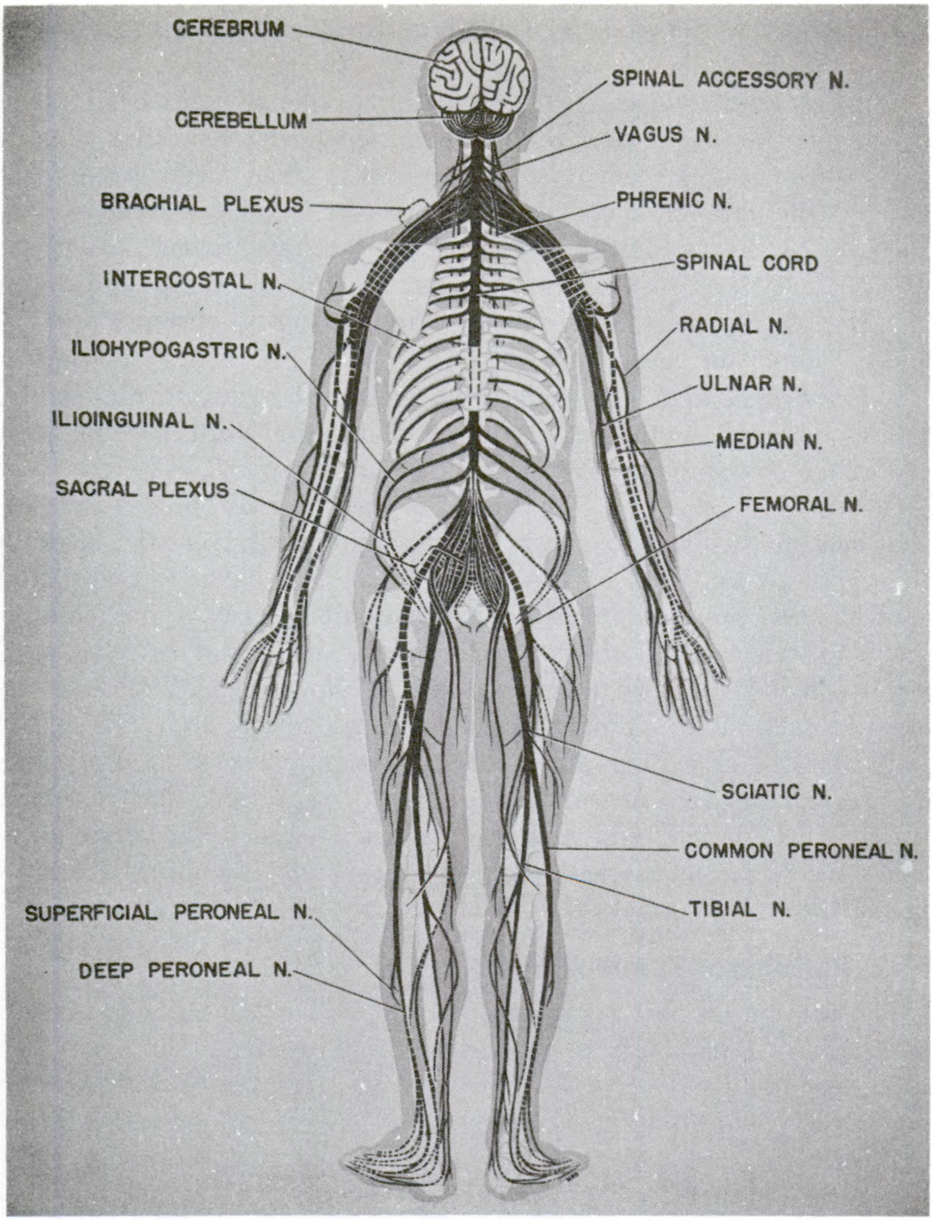


Figure 37. Principal nerve trunks.

voluntary fibers going to the smooth muscles and glands of the gastrointestinal tract, urogenital system, and cardiovascular system.

135. Autonomic Nervous System

The autonomic nervous system influences the activity of the cardiac and smooth muscle, sweat glands, digestive glands, and endocrine glands. Its control over these reactions is almost entirely involuntary; yet the behavior of the autonomic system reflects the activity of the central nervous system for the two are connected. The autonomic nervous system is divided into the *sympathetic* and the *parasympathetic* systems.

a. Sympathetic System. A number of ganglia (accummulations of nerve cells) located outside the vertebral column are the basis of the *sympathetic* or *thoracolumbar* system. These ganglia send nerves to smooth muscle, cardiac muscle, and glands throughout the body (fig. 38). Functions of this system are given in table III.

Table III. Functions of the Autonomic Nervous System

Sympathetic	Parasympathetic
1. Dilates pupils	1. Contracts pupils.
2. Lessens tonus of ciliary muscles, so that the eyes are accommodated to see distant objects.	2. Contracts ciliary muscles, so that the eyes are accommodated to see objects near at hand.
3. Dilates bronchial tubes	3. Contracts bronchial tubes.
4. Quickens and strengthens the action of the heart.	4. Slows the action of the heart.
5. Contracts blood vessels of the skin and viscera so that more blood goes to the muscles where it is needed for "fight or flight."	5. Dilates blood vessels.
6. Relaxes gastrointestinal tract and bladder.	6. Increases contractions of gastrointestinal tract and muscle tone of bladder.
7. Decreases secretions of glands (except sweat glands which secrete more).	7. Increases secretions of glands (except sweat glands).
8. Causes contraction of sphincters to prevent emptying of bowels or bladder.	8. Relaxes sphincters so that waste matter can be removed.

b. Parasympathetic System. The ganglia of the parasympathetic or *craniosacral* system are located along branches of one of the cranial nerves in the head and in the thoracic and abdominal organs. Ganglia in the head receive impulses from parasympathetic centers in the brain stem by cranial nerves and relay them to glandular, vascular, and smooth muscle structure. Ganglia in the thorax, abdomen, and pelvis receive impulses from the brain stem by the vagus nerve and from the spinal cord by sacral nerves. They relay impulses to the smooth muscle and glands of the organs where they are located. Functions of this system are given in table III.

c. Function of the Autonomic Nervous System.

(1) The function of the sympathetic system is to increase the activity of the organs of the body to enable it to meet danger and undergo strenuous physical activity. The effects of the parasympathetic system are opposite to those of the sympathetic system. The opposing functions of these two parts of the autonomic nervous system which balance each other are shown in table III.

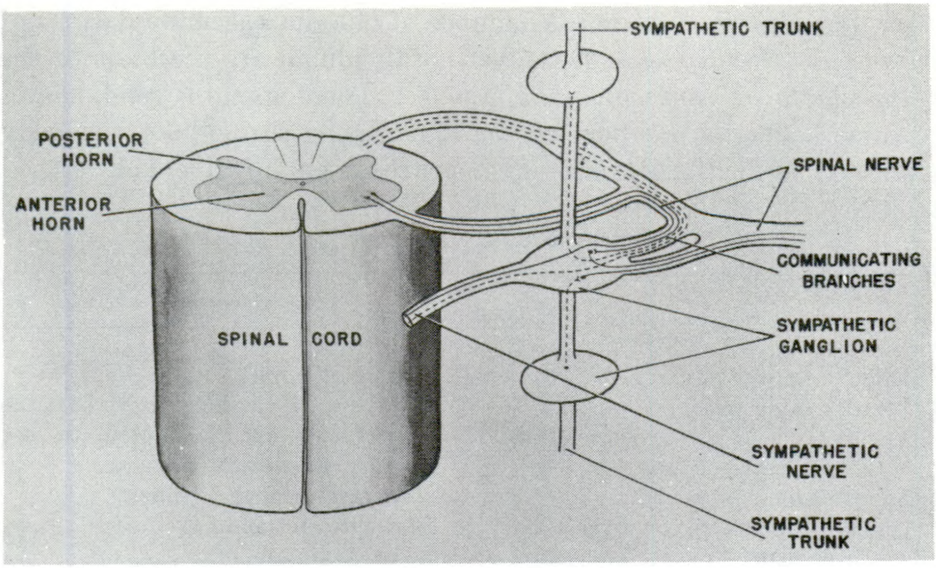


Figure 38. Relationship of the sympathetic and spinal nerves.

(2) During a period of quiet, the effect of the parasympathetic system is predominant. During a period of danger, emotional crisis, or strenuous exercise, the sympathetic system is active. The effects of this system's action show in the individual and are the symptoms of anger, fear, or exhilaration. It is a useful mechanism designed to help the individual in his period of stress.

136. Special Senses

Impulses from the skin and other sense organs are carried to the cerebrum (par. 164*b*). There they are converted into sensation. The parts of the sensory mechanism are—

The sense organ or receptor.

The pathway by which it is conducted into the central nervous system.

The sensory center in the cerebrum. The special senses include smell, taste, sight, and hearing.

a. Smell. Odor is detected and recognized by stimulation of cells located in the olfactory membrane of the nose. The detection of odors is not as well developed in man as it is in animals.

b. Taste. Taste buds are located in the tongue. The primary tastes are sweet, sour, bitter, and salt. The sense of taste may be influenced by the sense of smell. A person can identify foods more by the sense of smell than by the sense of taste. We can demonstrate the tastelessness of some foods by holding the nose when we eat them.

c. Sight (The Eye).

(1) The eye is the organ of vision, or sight. It is located in a bony cavity called the *orbit.*

(2) The eyeball is composed of a fibrous outer coat, a middle vascular coat, and an inner nervous coat called the *retina* (fig. 39). Light entering the eye stimulates cells of the retina. These stimuli create impulses that are carried by the optic nerve to the visual area of the brain, where perception occurs.

d. Hearing (The Ear). The ear is made of three main parts: the external ear, the middle ear, and the internal ear (fig. 40).

(1) *External ear.* The external ear is made of cartilage covered by skin. It projects from the side of head and receives sound waves which are carried by a canal, the *external canal*, to the *eardrum.* Sound waves cause the eardrum to vibrate.

(2) *Middle ear.* The middle ear is a space in the temporal bone filled with air and containing three tiny bones. These bones are the *malleus* or *hammer*, the *incus* or *anvil*, and the

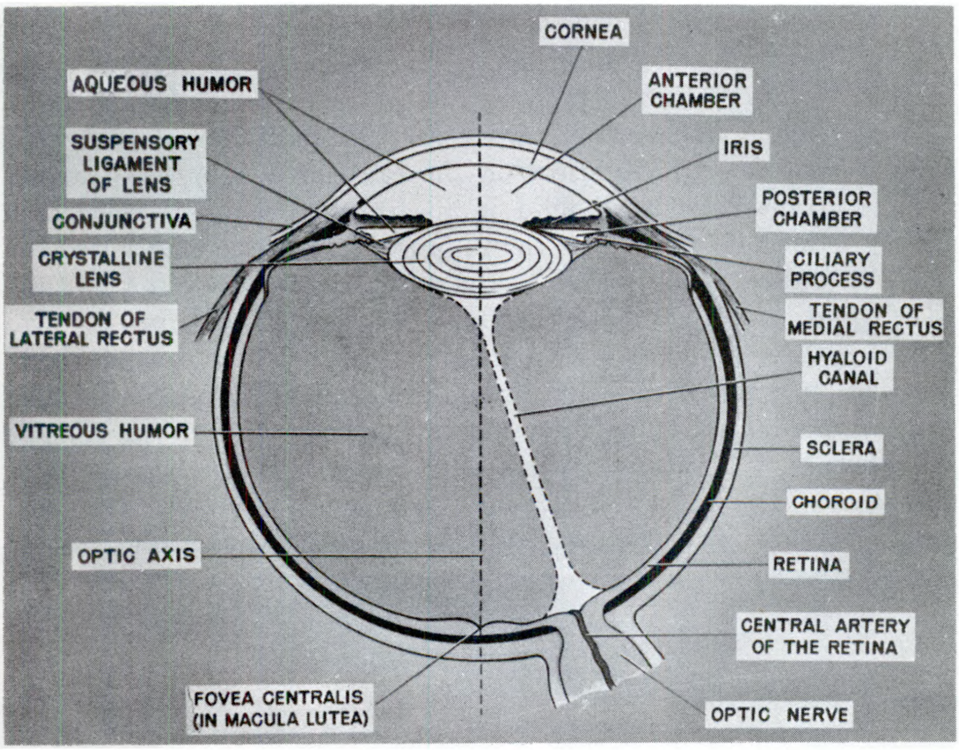


Figure 39. The eye.

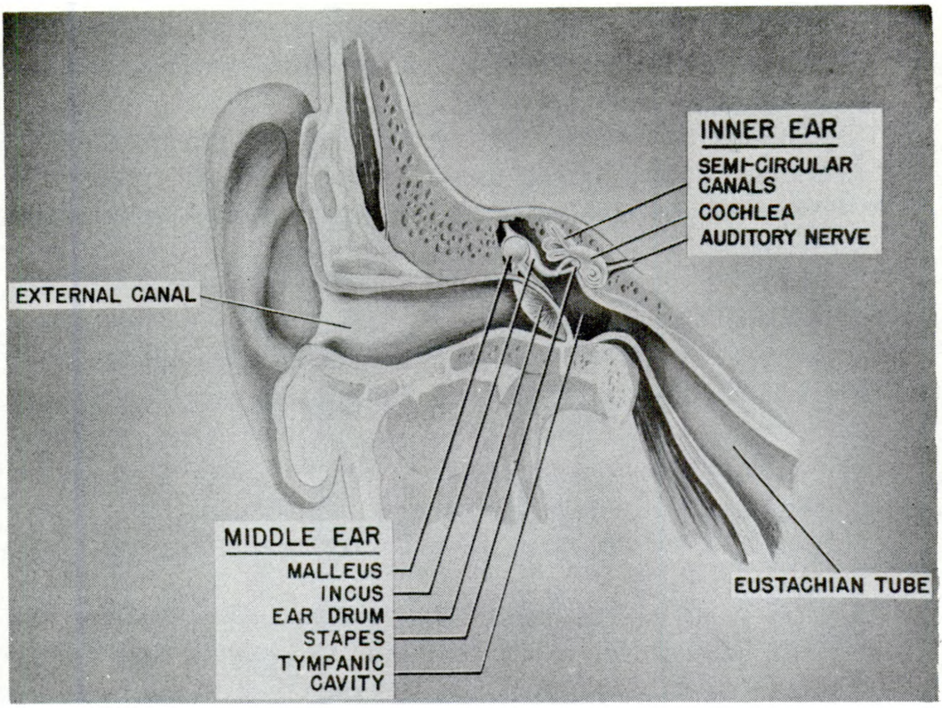


Figure 40. The ear.

stapes or *stirrup*. They conduct vibrations from the eardrum to the internal ear.

(3) *Internal ear*. The internal ear contains the receptors for hearing and equilibrium. The receptor for hearing is the *organ of Corti*. It lies inside a structure called the *cochlea*. Sound waves which have passed through the external canal and set up vibrations in the eardrum and middle ear are transmitted to a fluid in the internal ear. Movement of the fluid stimulates the organ of Corti to create nerve impulses which travel to the auditory center of the brain.

e. Equilibrium. Besides the organ of hearing, the internal ear contains three semicircular canals which regulate the sense of equilibrium. Change in position of the head causes movement of fluid within the canals. The fluid movement stimulates nerve endings in the walls of the canals which send impulses to the brain.

f. Other Senses. The skin and underlying connective tissue contain receptors for pain, temperature, touch, and pressure.

CHAPTER 4

EMERGENCY MEDICAL CARE AND TREATMENT

Section I. INTRODUCTION

137. Definitions

a. Military Surgery. This is surgery as it is provided and practiced in the military services. Military surgery applies some of the same principles as surgery in civilian situations. However, military surgery is set apart from civilian surgery by the many traumatic casualties during combat, the relative uncleanliness of the combat soldier, and the time lag from wounding to definitive surgery in combat.

b. Field Surgery. This takes in all lifesaving measures applied to a casualty in the combat zone. Field surgery has four distinct phases: self aid, first aid, emergency medical treatment, and initial surgery.

(1) *Self aid.* This is the treatment an injured soldier gives to himself. It is especially important in chemical and nuclear warfare. Both self aid and first aid for chemical and nuclear (and biological) warfare casualties are described in FM 21–40.

(2) *First aid.* This is the care an ill or injured soldier receives from other soldiers before treatment by medical service personnel is available. As first aid measures are part of emergency medical treatment, the medical soldier must be expert in their application. See FM 21–11 for first aid measures.

(3) *Emergency medical treatment.* This is the care given by medical service personnel to an ill or injured person until he can be given definitive (complete) treatment. Its purposes are to save life, to save limb, to prevent further injury, and to preserve resistance and vitality. The lifesaving value of emergency medical treatment is shown by statistics on United States Army battle casualties in past wars. Improvements in medical treatment (sec. II, ch. 1) reduced the death rate of these casualties, after they entered the system of evacuation, from 8.1 percent in World War I to 4.5 percent in World War II to 2.5 percent in the Korean War.

(4) *Initial surgery.* This is the first operative treatment given to a casualty by a medical officer. Tracheostomy and thoracentesis are examples of initial surgery.

138. General Procedure in Case of Injury

Observe the following rules:

a. Do not get excited. Examine the patient to find what is wrong. Decide as soon as possible what has to be done and which of the injuries needs attention first. Then give the patient as complete treatment as possible.

b. Keep the patient lying down with head level until examined for multiple wounds.

c. Examine the patient for hemorrhage, cessation or impairment of breathing, shock, and evidence of poisoning. These conditions take precedence over everything else because they are life-endangering; they demand immediate treatment.

d. Remove enough of the patient's clothing to get a clear idea of the extent of injury. Rip or cut clothing to avoid further wound contamination or injury. Removing clothing in the usual way may do great harm, especially if the patient has any fractures. Inspect the back as well as the front of the patient.

e. Record all findings and treatment on the emergency medical tag (par. 30).

f. Keep the patient warm and comfortable. A blanket under as well as over the patient may do him as much good as the dressing you apply to his wounds.

g. Assure the patient that his condition is understood and that he will get good care. Do not allow him to see his wounds. Do not talk about the patient's injury when he can hear you.

h. Never give morphine to patients with head, face, or neck injuries.

i. Never give anything by mouth to unconscious patients or to those with abdominal wounds.

j. Handle the patient gently. Unless necessary, do not move a patient until the extent of his injuries has been determined.

Section II. WOUNDS

139. General

a. A wound is any break in the skin, in mucous membranes, or in the continuity of an organ, bone, or tissue, caused by violence.

b. Wounds are classified by type, location, and causative agent. There are also subclassifications. Wounds may be single or they may be multiple. The part of the body most severely injured determines the primary classification of multiple wounds.

c. Abbreviations authorized for use in field medical records are listed in AR 40–400 and in the pad containing emergency medical tags. Abbreviations for types of wounds are given in paragraph 140. Other common abbreviations are: AI—accidentally incurred, KIA—killed in action, WIA—wounded or injured in action, DOW—died of wounds, and SIW—self-inflicted wound.

140. Classification of Wounds by Type

a. Closed Wounds. These are wounds in which there is no break in the skin.

(1) *Contused wound (CW)*, or contusion, is a subcutaneous injury, commonly called a *bruise*, caused by impact from a blunt object. There is little danger of infection, but swelling and black and blue discoloration may occur if blood leaks from the injured capillaries. When a larger blood vessel is broken the blood may collect in a pocket in the tissues. This collection is called a *hematoma.*

(2) *Dislocation* is the displacement of the normal relationship of the bones forming a joint.

(3) *Sprain* is an overexertion, overstretching, or tearing of ligaments around a joint.

(4) *Strain* is the stretching or tearing of a muscle or a tendon.

(5) *Fracture, closed*, is the breaking of a bone without a break in the overlying skin.

(6) *Rupture* occurs when a muscle or an internal organ bursts because of pressure from a hard blow or an explosion. With a rupture, there may be no injury to the skin or no external evidence of a wound.

b. Open Wounds (1 and 2, fig. 41). These are wounds in which the skin and underlying structures are cut, torn, or penetrated.

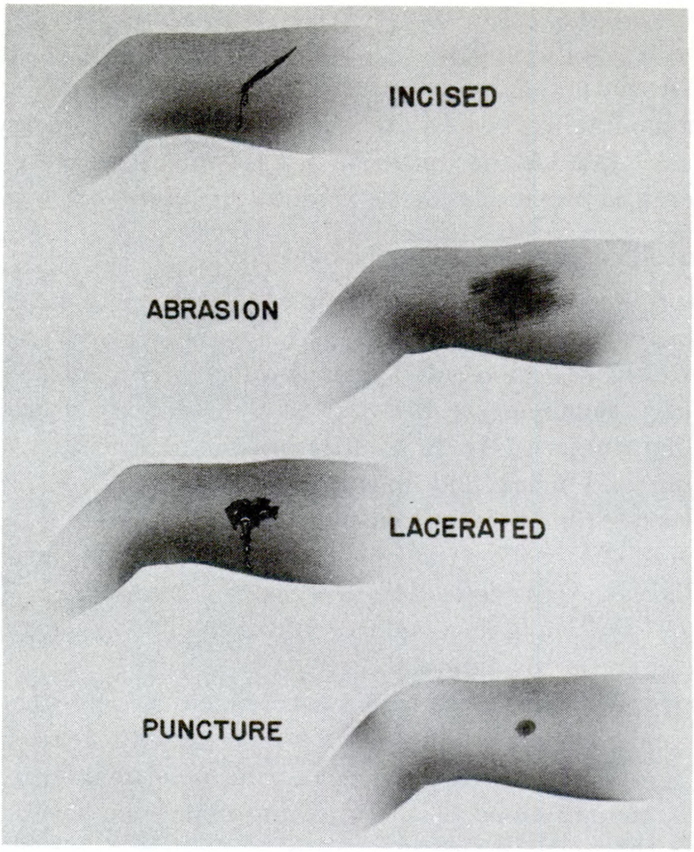
(1) *Lacerated wound (LW)* is a wound that is irregular and torn, with jagged edges. This type of wound might be caused by bomb or high explosive shell fragments.

(2) *Incised wound (IW)* is a cut made by a sharp object such as a knife, a bayonet, or broken glass.

(3) *Abrasion* is a wound in which outer layers of the skin have been scraped off or scratched. An abrasion results when a rough object is rubbed forcibly along the skin.

(4) *Puncture wound* is one caused by a sharp and pointed object such as a nail or an ice pick. Even though the wounding agent is withdrawn from the wound, it may carry bacteria deep into the tissues. This enables tetanus or other infection to develop in the wound.

(5) *Penetrating wound (Pen W)* is one in which a foreign object enters the body and lodges there.



1 Classification
Figure 41. Types of wounds.

(6) *Perforating wound (Perf W)* is a wound that goes all the way through the body, the head, or a limb.
(7) *Fracture, open*, is a break in the bone that communicates with the outside surface of the skin through a wound channel or by protrusion of a bone fragment through the skin.

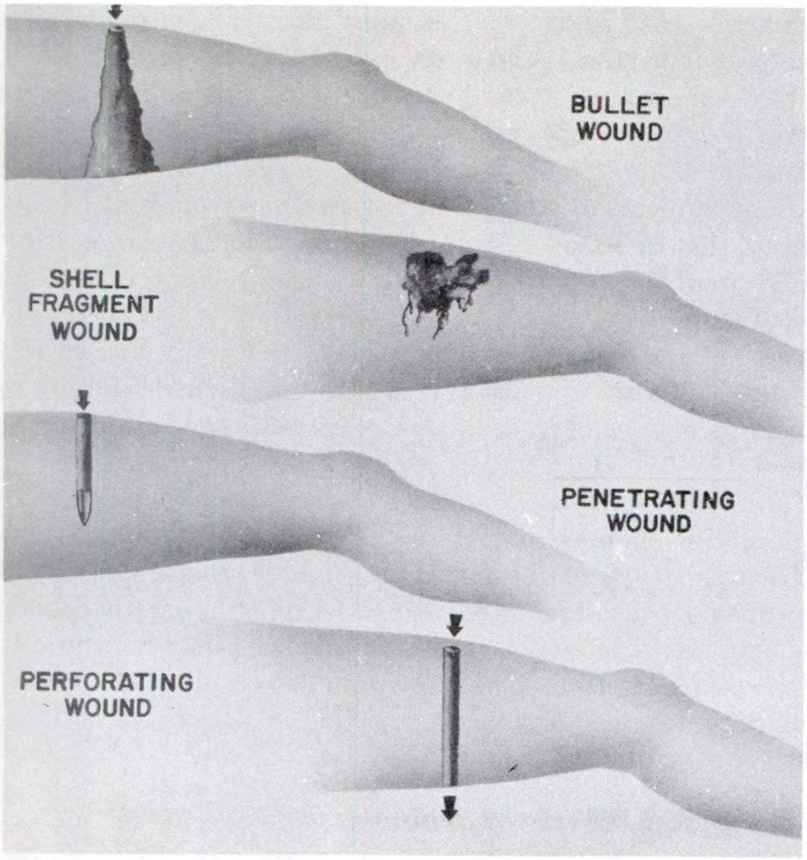
141. Classification of Wounds by Location

Wounds are classified according to anatomical parts of the body as head wounds (these are subdivided into skull, face, and jaw wounds); chest wounds; abdominal wounds; wounds of the extremities (arms or legs); wounds of joints; and spinal and pelvic wounds.

142. Classification of Wounds by Causative Agents

Classification according to the agents causing wounds is especially important in diagnosis and treatment. The most common causative agents are discussed below.

a. Bullet Wounds (2, fig. 41). These wounds vary greatly in severity and form. Many bullet wounds, particularly those caused by the smaller caliber weapons or bullets which have nearly spent themselves, pass through the tissue, doing little harm, and leave an "ice



2 Causative agents and effects.
Figure 41—Continued.

pick" wound. The small wounds of entrance and exit, connected by a tract, are usually clean. Usually little damage is done unless the bullet hits a bone, vessel or nerve. Often little or no treatment is necessary and recovery is rapid. Rifle bullets of large caliber cause wounds of various types. Frequently the wound of entrance is small and the wound of exit large and lacerated, but this is not always the case. Sometimes the exit wound is smaller than the wound of entrance. Damage varies with the toughness and elasticity of the tissue. Skin is tough and elastic and frequently will stretch during the expansion of the tissue caused by the bullet and be relatively uninjured. Muscle, however, is usually damaged greatly. Nerve tissue and blood vessels are tough and elastic, and will hold together. Frequently nerves and blood vessels survive intact even though surrounding muscle tissue is killed. In fact, many times an intact nerve or vessel is seen strung from one wall of a wound to the other. Bone is tough but brittle and so it frequently cracks due to the impact of a bullet suddenly entering the tissue, although the bullet does not hit the bone directly. Damage to the abdomen varies with the type of organs that are hit. If the bullet passes through a solid organ, such as the liver, spleen, or stomach full of food, it has an explosive effect and tears

large amounts of tissue. If the bullet does not encounter liver or spleen, or if it perforates an empty stomach, the chances are it will make the same sort of small holes in the organs as it makes at the wound of entrance in the skin.

b. Shell or Bomb Fragment Wounds. These wounds are caused by sharp, jagged pieces of steel of almost any size from that of the head of a pin to that of a man's hand. Generally they are large, irregular, lacerated wounds with much tissue damage. They often have no wound of exit.

c. Bayonet and Knife Wounds. These are usually incised wounds.

d. Burns. These wounds are caused by thermal (heat) agents, chemicals such as acids and alkalies, electricity, and radioactive substances.

e. Conversion or Blast Injury Wounds. These wounds are due to sudden, terrific changes in pressure. Frequently no open wound results from this type of injury. For example, the lungs may be injured, causing considerable edema and hemorrhage; the abdominal organs may be ruptured; or the nervous system may be injured.

f. Poisoned Wounds. These are wounds complicated by the presence of poison. Such wounds are snake or poison insect bites and usually are puncture wounds.

143. Dangerous Effects of Wounds

A wound can have four effects which threaten life. These are: hemorrhage, mechanical defects, infection, and tissue destruction.

a. Hemorrhage. All parts of the body depend upon the circulatory system to supply their vital needs. Hemorrhage breaks this vital line of supply. Sudden loss of a large amount of blood can produce shock severe enough to require immediate treatment to save life. Loss of one-half the body's blood volume is usually fatal.

b. Mechanical Defects. Wounding may produce mechanical defects, such as a sucking chest wound or an obstruction of the airway, which cause death unless corrected quickly.

c. Infection. All open wounds are contaminated by bacteria either from the wounding agent or the skin. Even the smallest open wound may contain tetanus or other organisms which produce infections. Usually it is 4 to 6 hours before bacteria in a wound multiply and invade tissue. This is the best time for treatment to prevent infection.

d. Tissue destruction may cause death by (1) injury to organs or systems or (2) poisons released from dead tissues.

Section III. INFLAMMATION AND WOUND HEALING

144. Inflammation

Inflammation is the local reaction of the body to irritation or injury. It occurs in tissue that is injured but not destroyed. It is a

defensive and protective effort by the body to isolate and eliminate the injuring agent and to repair the injury. Inflammation plays an important, and usually helpful, part in fractures, dislocations, sprains, open wounds, burns, frostbite, and infection.

a. Causes. Inflammation can be caused by any of the following kinds of injuring agents:

(1) Traumatic, such as blows and mechanical irritation.

(2) Chemical, such as venom of snakes, mustard gas, acid, poison ivy, or stings of insects.

(3) Heat or cold.

(4) Pathogenic (disease-causing) bacteria, such as staphylococcus and streptococcus.

(5) Other agents, such as electricity, X-ray, and rays of the sun.

b. Signs. The signs of inflammation are redness, heat, swelling, pain, and disturbance of function. These five signs are produced by reaction of blood vessels and tissue in the injured area. When injury occurs, the blood vessels dilate, thus increasing the supply of blood to the injured area. The blood is warm and red, producing the first two signs, *redness* and *heat.* As the blood vessels dilate, their walls leak and blood serum escapes into the tissues. This results in the *swelling.* Pressure of the swelling on nerve endings causes *pain. Disturbance of function* can result from the pain or from interference by the swelling. While changes in blood vessels are producing the cardinal symptoms of inflammation, the body is reacting to the injury in another way. White cells leave the dilated blood vessels and move through the tissue fluids to the site of injury (fig. 42). The cells make a wall around the area to seal off the injurious agent. Within

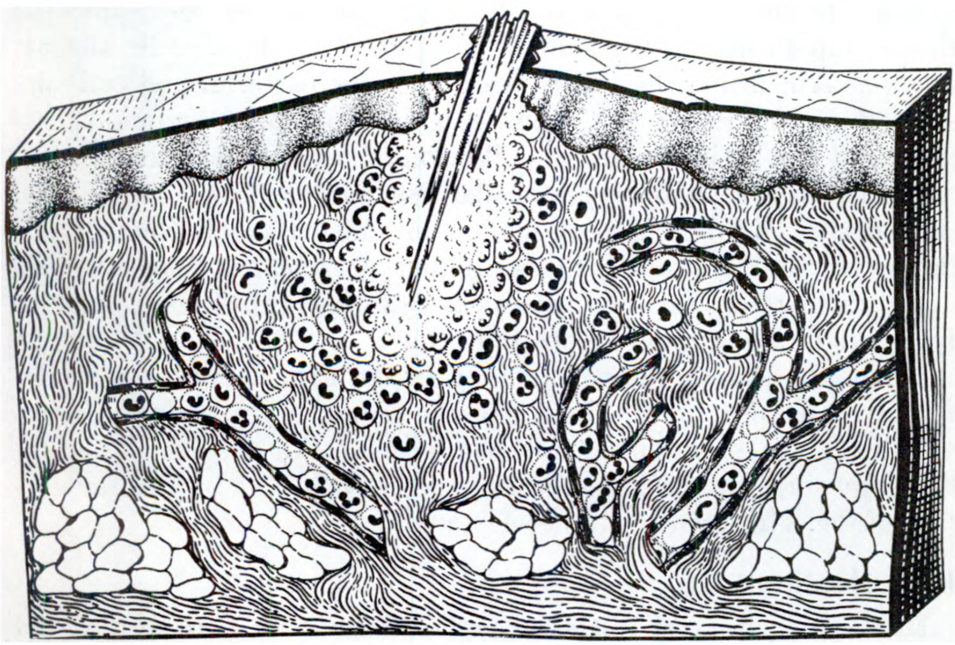


Figure 42. Tissue changes in inflammation.

this area the white cells work as scavengers (phagocytes), and ingest small particles of foreign matter, dead tissues, or bacteria if present. As the source of injury is overcome or expelled, tissues return to normal. White cells disperse. Blood vessels return to normal size. Fluids flow away through the lymphatics. If tissue has been destroyed, it is replaced by scar tissue. Thus, the dilation of blood vessels and the mobilization of white cells against the injuring agent are the two basic reactions in the inflammatory process.

145. Septic Inflammation

Septic inflammation is inflammation caused by bacteria. Usually the white cells and blood fluids from dilated capillaries can localize and destroy invading organisms. The principal danger in septic inflammation occurs when body defenses fail to overcome the bacteria. If this happens, bacteria and their associated poisons enter the blood stream and, therefore, are spread throughout the body. This condition is called *septicemia.* Pathogenic bacteria exist on the skin, in the mouth, and on everything that has not been sterilized. Normally, the intact skin and mucous membranes keep bacteria from entering the body. However, when there is a break in the skin or the mucous membranes are irritated, bacteria may enter the body, invade tissues, and produce septic inflammation. Not all bacteria cause the same degree of inflammation. Some cause mild inflammation. Others cause severe inflammation. That is why one infection appears as a pimple, while another takes the form of a boil.

146. Abscess Formation

a. In the process of inflammation, white blood cells move into the tissues and form a wall about the injured area. These cells also attack bacteria inside the walled area. Tissue, bacteria, and cells destroyed in the struggle mix with tissue fluids to form the liquid matter called *pus.* This walled-in collection of pus is called an abscess.

b. The most common types of abscesses are furuncles (boils) and carbuncles. A furuncle is an abscess in which the collection of pus lies within the tissue below the true skin. A carbuncle is an infection in which there are several abscess cavities often growing together to form one large abscess beneath the skin.

c. Abscesses occur most commonly in the skin, but they may develop in any part of the body—in the bones, brain, kidneys, liver, muscles, lungs, or in spaces between organs. An abscess, if not relieved by surgical incision and drainage, may find its way to the surface of the skin, open spontaneously, and drain.

147. Healing

Healing is a process related to inflammation, for both are started by tissue injury. It would be ideal if the body could heal itself

by replacing all damaged tissues with an exact counterpart. Thus, an eye would be replaced with a new eye and a tooth with a new tooth. But very few tissues are replaced in kind. Examples of tissues which may replace themselves are liver tissue, kidney tubules, and connective tissue. Bone—which is one kind of connective tissue—may replace itself if broken. That is, the broken bone is repaired by the formation of new bony tissue. Healing in most tissues is, however, a process of replacement; the destroyed tissue is replaced by scar tissue (fibrous type of connective tissue). If brain cells are destroyed, they are replaced by connective tissue. If the heart muscle is injured, the damaged fibers are replaced by connective tissue. When a tooth is pulled or an eye lost, the sockets are filled with connective tissue. Hence, replacement by scar tissue is the usual order in healing. In wound healing this may happen in one of two ways—

a. Primary Union. A clean wound is closed by suturing so that its walls are pressed against each other. Fiber-forming cells carry fibers from one wall to another, binding them together. When the process is completed, the walls are held and healed by a thin scar of fibrous connective tissue. If the skin has been involved, epithelium grows out from the cut edges of the skin to cover the scar (fig. 43).

Figure 43. Wound healed by primary union.

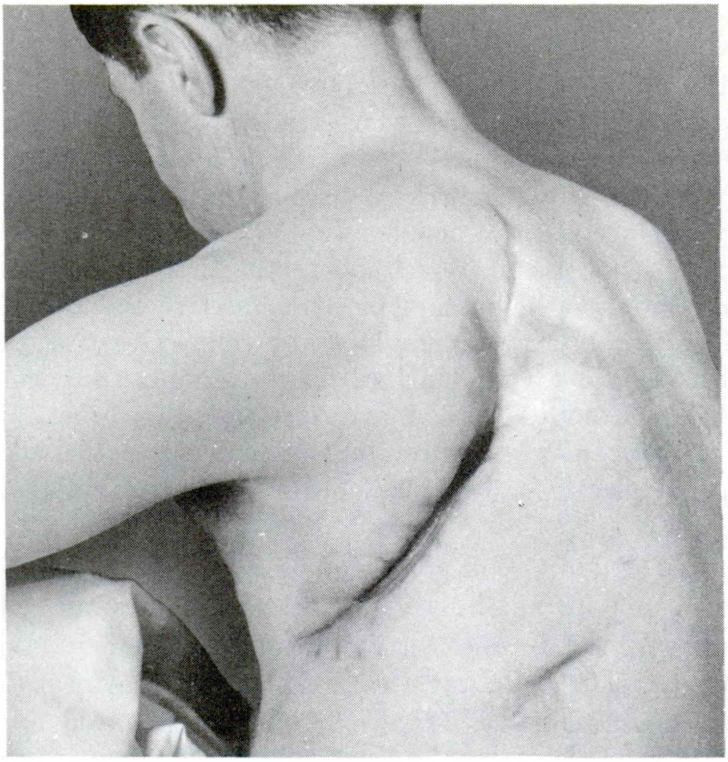


Figure 44. Wound healed by secondary union.

b. Secondary Union. When a wound is left open, healing takes place by the cavity filling from the bottom up. On the walls and base of the wound a tissue forms composed of capillaries and fiber cells; this is called granulation tissue. It gradually fills the wound, crowding out all foreign matter, and is finally covered by epithelium growing in from the cut edges of the skin (fig. 44).

Section IV. EMERGENCY TREATMENT OF WOUNDS

148. Exposing the Wound

To give proper emergency treatment, you must expose the entire wound to learn exactly where it is, how large it is, and how much it is bleeding. When a wound has been caused by a bullet, a shell fragment, or other object which could have gone all the way through a part of the body, look for a wound where the missile may have come out, because the wound of exit is usually larger than the wound of entrance. To see all wounds which are present, cut, tear, or remove the clothing as much as necessary. Do not drag clothes over a wound; carefully lift them off. At the same time do not let the patient get cold.

149. Hemorrhage

Hemorrhage or bleeding is the escape of blood from blood vessels. Hemorrhage may be arterial, venous, or capillary, or all three. It it a serious threat to life. Its prompt control is vital.

a. Types of Hemorrhage.

(1) *Arterial hemorrhage.* When bleeding is from an artery, there is a rapid flow of *bright red blood* usually escaping in spurts with each beat of the heart. Because blood is lost rapidly, this is the most dangerous type of bleeding. It demands prompt and efficient treatment. The wounded part must be elevated if possible and direct pressure applied to the wound. If these measures fail a tourniquet is applied at once.

(2) *Venous hemorrhage.* In bleeding from a vein, there is a rapid flow of *dark red blood.* The blood wells up into the wound steadily, without spurting. Venous hemorrhage is treated by elevation of the wounded part and by direct pressure over the wound with a sterile dressing. The use of a tourniquet rarely is necessary.

(3) *Capillary hemorrhage.* This is a steady oozing of blood from the wound. It is treated by elevation of the wounded part and by direct pressure on the wound with a sterile dressing.

b. Symptoms of Hemorrhage. The following symptoms are usually present both in internal and external hemorrhage:

(1) The skin is pale, cold, and moist.
(2) Breathing is rapid, irregular, and shallow.
(3) Pulse rate is rapid, feeble, and irregular.
(4) Blood pressure is lowered.

150. Control of Hemorrhage

There are five methods for controlling hemorrhage. Pressure is the basic principle of all.

a. Elevation of the Part (fig. 45). Raise the bleeding part as high as possible above the level of the heart but without hurting the patient or injuring the wound. Elevation aids the venous return and lowers blood pressure at the wound, thus slowing blood loss. Elevation of the part will not control bleeding entirely; it must be accompanied by pressure over the wound. Elevation is *not* used if there is a fracture in the bleeding part or if movement will cause further injury.

b. Direct Pressure Over the Wound (fig. 46). Place a sterile dressing over the wound and press firmly on the dressing. Keep up the pressure at least 5 minutes or until bleeding stops. Use a second dressing if one is not enough to cover the wound. Then hold

Figure 45. Elevation of leg to stop bleeding.

Figure 46. Direct pressure over wound to stop bleeding.

the dressing in place by bandaging. All venous and capillary bleeding and, in most instances, arterial bleeding can be controlled by direct pressure.

c. Digital Pressure. This finger pressure applied directly over the main artery supplying the bleeding part. Pressure is applied between the wound and the heart and at a point where it is possible to press the artery against a bone. Proper finger pressure is useful in controlling arterial bleeding for a short time. It is used only until a better method can be applied. The major pressure points for controlling external bleeding are discussed below.

(1) *Temporal.* Pressure on the temporal artery helps control bleeding from the scalp. Apply pressure over the artery at a point just in front of the ear on the side of the head where the wound is.

(2) *Facial.* Pressure on the facial artery will usually stop bleeding from the face. The pressure point for this artery is on the lower edge of the jaw bone, in a groove about one-third of the way forward from the angle of the jaw.

(3) *Brachial.* Pressure on the brachial artery is used against bleeding in the arm. Apply pressure on the inner side of the upper arm, in the groove behind the biceps muscle, about halfway between the shoulder and elbow. Press artery against bone of upper arm.

(4) *Subclavian.* Pressure on the subclavian artery is used to stop bleeding from the shoulder. The artery is pressed against the first rib in the hollow just above the clavicle (collarbone).

(5) *Femoral.* Pressure on the femoral artery reduces bleeding from the thigh, leg, and foot. Pressure is applied at a point in the middle of the groin (the inside of the thigh) where the artery can be pressed backwards against the pelvic bone.

d. The Tourniquet (figs. 47 and 48). A tourniquet is a band placed around an arm or leg so tightly that compression blocks the arteries. It is used to stop arterial or other severe bleeding that cannot be controlled any other way. When a tourniquet is needed it must be applied promptly and properly.

(1) If a regular issue tourniquet is used, the buckle should be adjusted as shown in figure 47, and the strap pulled in a downward direction while the injured part is steadied. If an issue tourniquet is not available, improvise using a belt, cravat, rope, or handkerchief for the strap. Knot it about the arm or leg and twist it up with a stick.

(2) A tourniquet must be drawn up tightly. The most common mistake made with a tourniquet is to put it on too loosely.

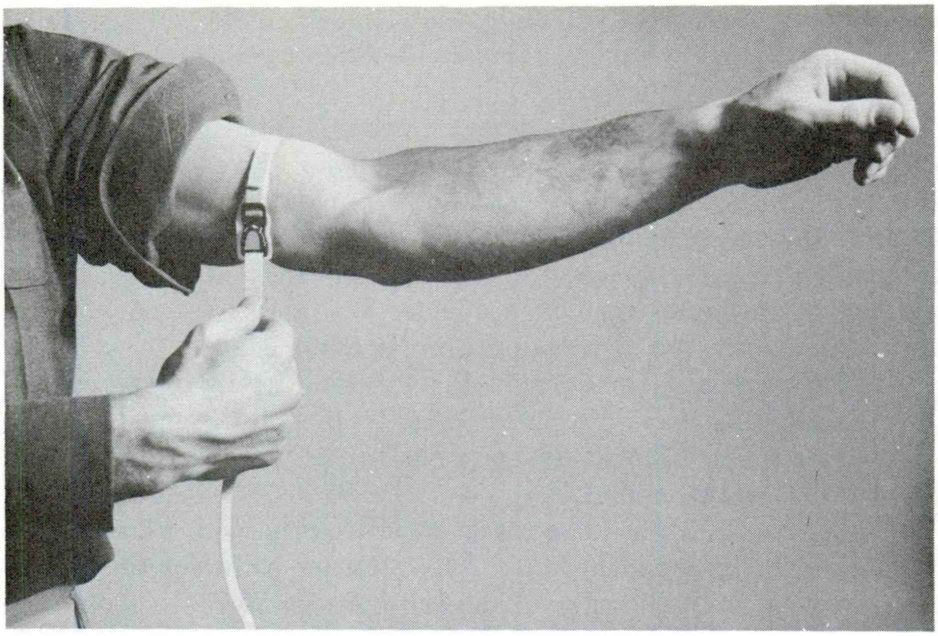


Figure 47. Application of tourniquet to arm.

Figure 48. Improvised tourniquet.

A loose tourniquet blocks the veins but not the arteries, so that even more blood is lost. If a tourniquet cannot be drawn tightly enough by hand, place a stick or bayonet between the strap and the skin and twist it like a windlass (fig. 48). Check the pulse of an artery below the tourniquet; when the pulse disappears the artery is blocked and the tourniquet is tight enough.

(3) For bleeding from the arm or leg, never apply a tourniquet over a bony part such as wrist, elbow, ankle, or knee. It is more efficient when applied over fleshy parts such as the thigh or upper arm. The tourniquet should be applied as close as possible to the edge of the wound. If bleeding continues, the tourniquet should be moved above the knee or the elbow, whichever is applicable. Apply a tourniquet to all traumatic amputations except amputations of the fingers or the toes.

(4) Once the tourniquet has been applied, the wounded man should be seen by a medical officer as soon as possible. The tourniquet should not be loosened by anyone except a medical officer prepared to control the hemorrhage by other means and to replace the blood volume deficit adequately. Loosening of the tourniquet by inexperienced personnel or without proper control facilities can result in additional blood loss and endanger the life of the patient.

(5) When a tourniquet has been applied to a casualty, this fact and the time of application should be written on his emergency medical tag.

e. Clamping. If the end of the bleeding vessel can be located, and if a sterile clamp (hemostat) is available, the vessel may be clamped. You must be extremely careful not to clamp any tissue except the blood vessel. A medical officer should approve this procedure.

f. Fluid Replacement. The replacement of lost body fluids with whole blood or blood volume expanders (par. 159) is almost as important as the control of hemorrhage in saving life.

151. Application of Dressing and Splints

The proper application of a sterile dressing is an important means of preventing infection as well as stopping bleeding. To use the first aid packet (fig. 49), carefully remove the dressing from its carton. Tear off one end of the waterproof paper inclosure. Remove the sealed dressing and tear the sealed container lengthwise. Open the dressing by pulling on the two folded tapes attached to it (fig. 50). Keep the back of the dressing (colored red) toward you. Be careful not to touch the other side of the dressing; it goes

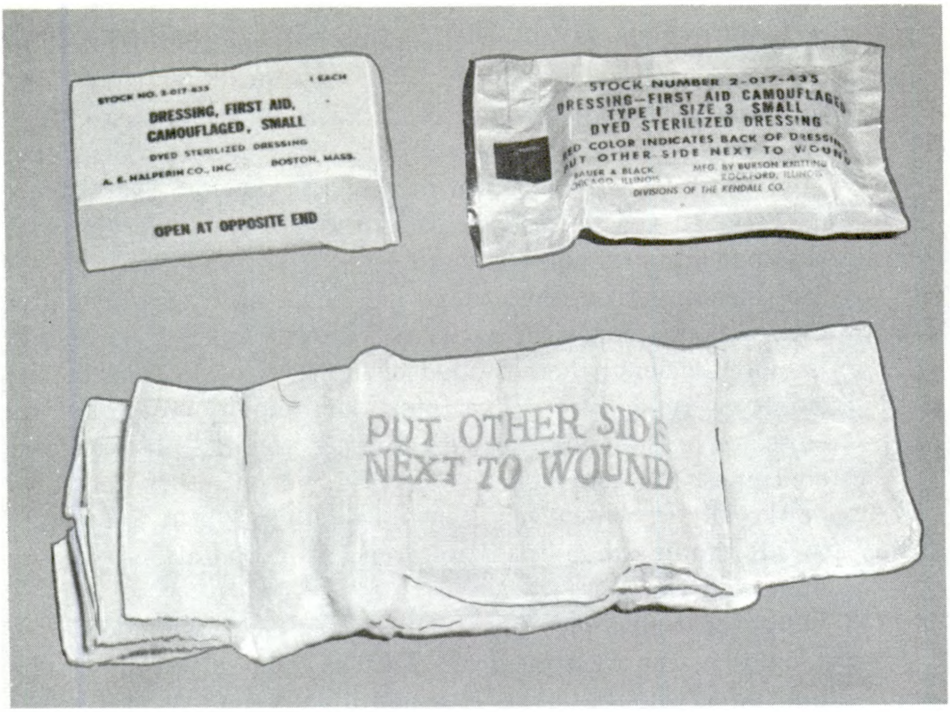


Figure 49. First aid packet.

next to the wound. Still holding one folded tape in each hand, apply the compress to the wound (fig. 50); then wrap the tapes around the injured part and tie the ends together. Always use the packet belonging to the injured man. If another is needed, use one from the medical kit. A severely wounded arm or leg, if possible, should be splinted or put in a sling after dressings have been applied, even if no bone is broken. This keeps the injured part at rest and helps to prevent bleeding and to lessen pain and shock.

152. Maintenance of Airway

Maintenance of an open airway is essential at all times. Failure to relieve respiratory obstruction is a major cause of death among battle casualties. The primary causes of obstruction are mucus, blood, vomiting, and a relaxed tongue. Methods for relieving these and other causes of obstruction, thus providing an adequate airway, are given in paragraph 191*b*.

153. Use of Antibiotics

In all open wounds or burns, treatment with penicillin or other antibiotics should be started promptly. Early use of antibiotics is important in suppressing bacterial growth at the site of wounding. Early antibiotic therapy is especially valuable to casualties with abdominal wounds where the peritoneal cavity has become contaminated with fecal matter.

Figure 50. Application of dressing to wound.

154. Tetanus Toxoid

Look at the patient's identification tags to see if he has had his series of immunizing tetanus injections. If he has, give ½ cc. of tetanus toxoid subcutaneously, using sterile precautions. If he has not received tetanus immunization, give tetanus antitoxin.

155. Morphine and Relief of Pain

Some pain occurs sooner or later after all wounds. Pain may be mild, moderate or severe, depending on the casualty and the wound. Pain often is so mild that it does not require special attention, but if pain is severe it must be relieved. Often you can prevent or relieve pain by keeping the injured person quiet and warm, carefully changing his position to keep him comfortable, handling him gently during transportation, and splinting the injured arm or leg.

a. Indications for Morphine. Only when simple measures fail and severe pain continues, or when a severely injured person must be moved quickly, as from a wrecked vehicle or aircraft, is it wise to give morphine at once. If use of morphine is definitely indicated, do not hesitate to give it. Its ability to stop pain (*b* below) may be lifesaving. Pain can increase the severity of shock, and shock is deadly.

b. Action of Morphine. Morphine is the most potent of the drugs derived from opium. It is a powerful depressor of the central nervous system, having a selective action on *respiration* and *pain sensation.* These functions are greatly reduced by amounts of morphine that have little effect on general consciousness. Morphine is valuable because it can relieve severe pain, but it is dangerous. It has a strong depressant action on respiration, and addiction to it is easily established. Morphine never should be used by anyone who is not fully aware of its dangers.

c. Administration of Morphine. Morphine syrettes (fig. 51) will be found in the individual surgical instrument and supply set and in battle group aid station equipment. At times morphine syrettes may be issued to every medical soldier. They are prepared for immediate injection in collapsible tubes with sterile needles (figs. 51 through 55).

(1) Remove transparent head of morphine syrette. Grasp wire loop and push in the wire to pierce the inner seal, turning the wire if necessary (fig. 53). Take care not to touch needle with fingers or any other object. Pull out and discard wire. Prepare the skin with available antiseptic or alcohol. Use a part of the skin that can be quickly and easily exposed, such as the upper arm, thigh, or calf of the leg. Thrust the needle through the skin at least half its length, and inject solution by slowly squeezing syrette from

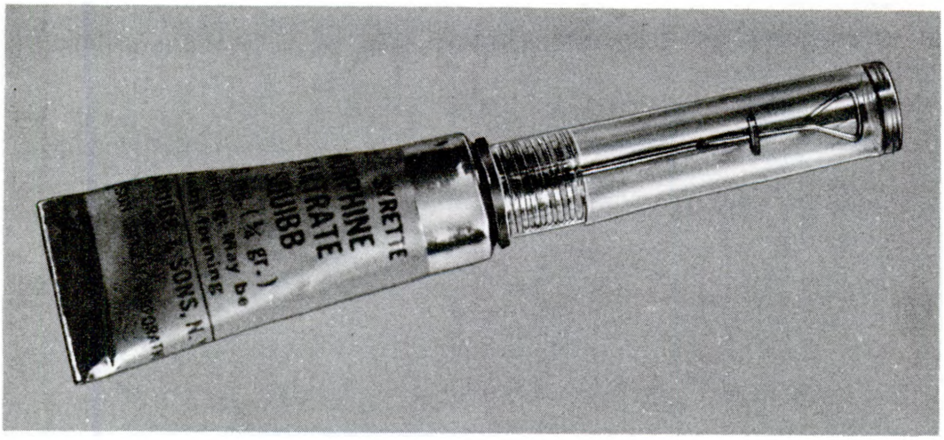


Figure 51. Morphine syrette.

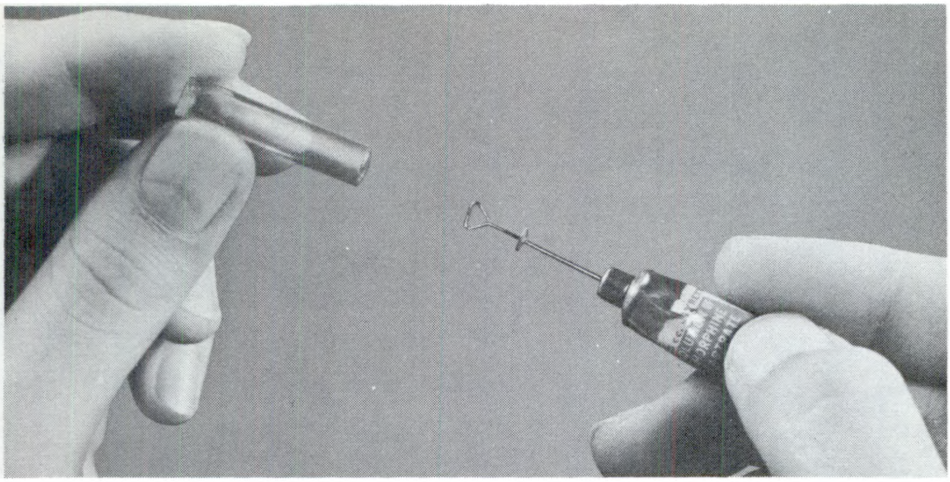


Figure 52. Removing transparent head from syrette.

the sealed end as shown in figure 55. The usual route of administration is intramuscular. If pain is quite severe, a medical officer may give a small dose of morphine intravenously.

(2) The dosage for morphine is ¼ grain or 16 mg. If the syrette contains ½ grain, squeeze out one-half of the contents; then inject the remainder (¼ grain). If the syrette contains ¼ grain, inject all the contents. After injection, withdraw the needle, and pin the syrette on the lapel of the patient's jacket.

(3) Always record on the patient's emergency medical tag, or other medical record, every dose of morphine. Write on the tag the amount given, the time, and the site of injection.

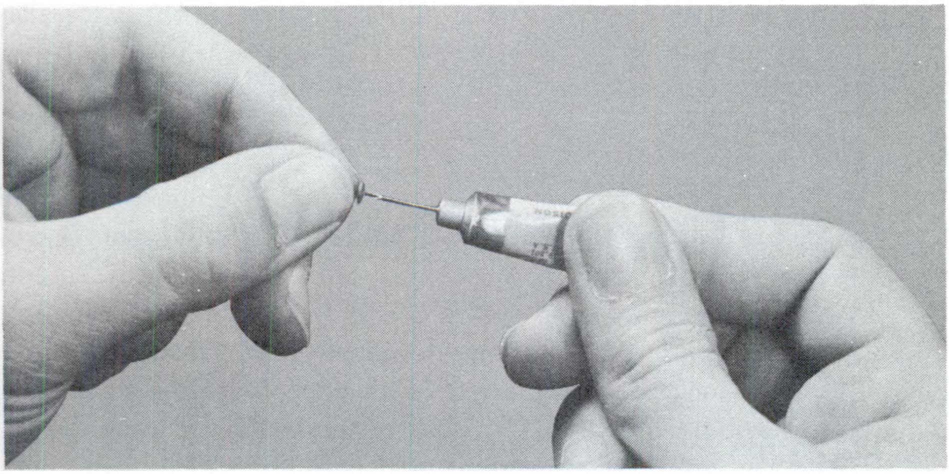


Figure 53. Puncturing inner seal of syrette.

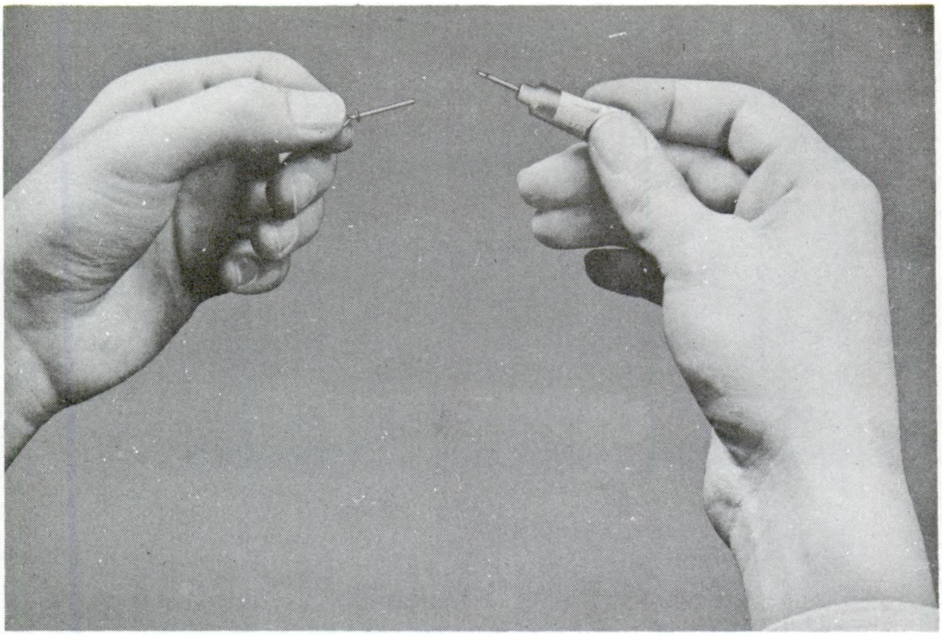


Figure 54. Removing wire loop from syrette.

d. *Contraindications for Morphine.*

(1) *Abdominal pain.* A person's life may depend upon the correct diagnosis of abdominal disease, and pain is an important symptom. Relief of pain causes the true picture of the symptoms to become blurred. A diagnosis made on this basis may not be accurate. Therefore, morphine should not be given for any undiagnosed abdominal condition.

(2) *Injuries of the head.* Morphine is contraindicated because it distorts the symptom picture and interferes with diagnosis.

(3) *Chest injuries or depressed respiration.* Morphine should not be given to anyone with a chest injury or whose respiratory rate is under 12 per minute. In such a case the drug would increase respiratory depression, and this might be fatal.

(4) *Unconsciousness.*

(5) *A prior dose of morphine.* A dose of morphine never should be repeated within 2 hours. It should not be repeated at all unless necessary to control pain. It should not be repeated if there is any reason to believe the first dose has not been absorbed. Sometimes when a patient is in shock, his circulation is so poor that injected drugs are not absorbed. If a dose of morphine is repeated in such a case, both injections will be absorbed at once when circulation is restored, and morphine poisoning will result.

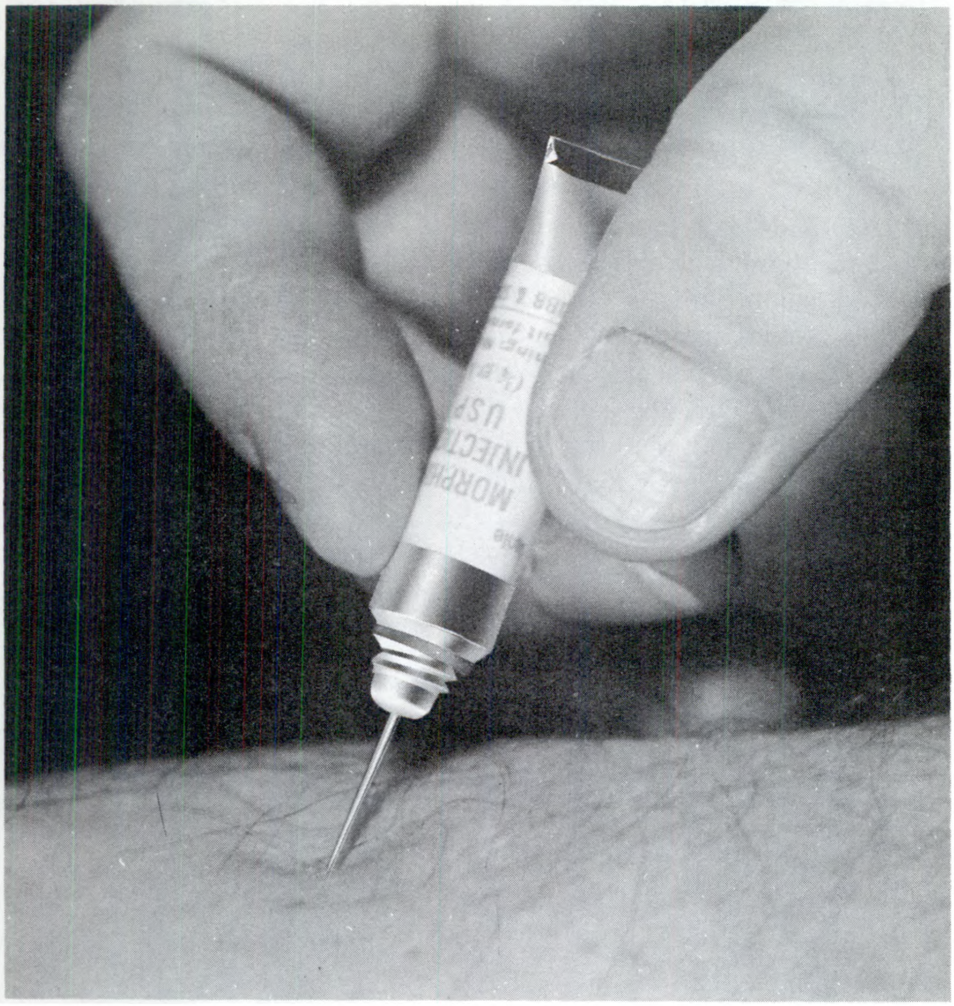


Figure 55. Injecting morphine from syrette.

(6) *Impending surgery.* If there is a possibility that the patient may soon be operated on, morphine should not be given unless ordered by a medical officer. Morphine and surgical anesthesia both act to depress the respiration.

(7) *Sedative.* Morphine should not be used as a sedative in the treatment of anxiety, fear, or hysteria.

(8) *Walking wounded.* Morphine should not be given in the field to walking wounded. The drug will cause some to become confused and nauseated, and will increase disability in other ways.

(9) *Shock.* Morphine should not be used in shock unless severe pain is present and is retarding the effect of shock treatment. If morphine is ordered for a patient in shock it should be given intravenously (by a medical officer) rather than intramuscularly.

(10) *Liver disease.* Morphine should not be given in cases of hepatic (liver) disease or infection.

156. Shock

a. Definition of Shock. Shock is a condition in which there is not enough blood in circulation to fill the vascular system. As a result the tissues do not get the amount of oxygen needed to maintain life, and there is collapse or extreme body weakness. Reduction of blood volume in the circulation can result from—

(1) Actual loss of blood through hemorrhage.

(2) Loss of plasma, the fluid part of blood, through leaking capillaries (fig. 56).

(3) Abnormal increase in the capacity of the vascular system (dilatation of many blood vessels at the same time).

b. Cause of Shock. Injury is the major cause of shock in combat casualties. Injury may be the loss of blood, the burning, crushing, tearing, or freezing of tissue, the exposure of internal organs, or pain.

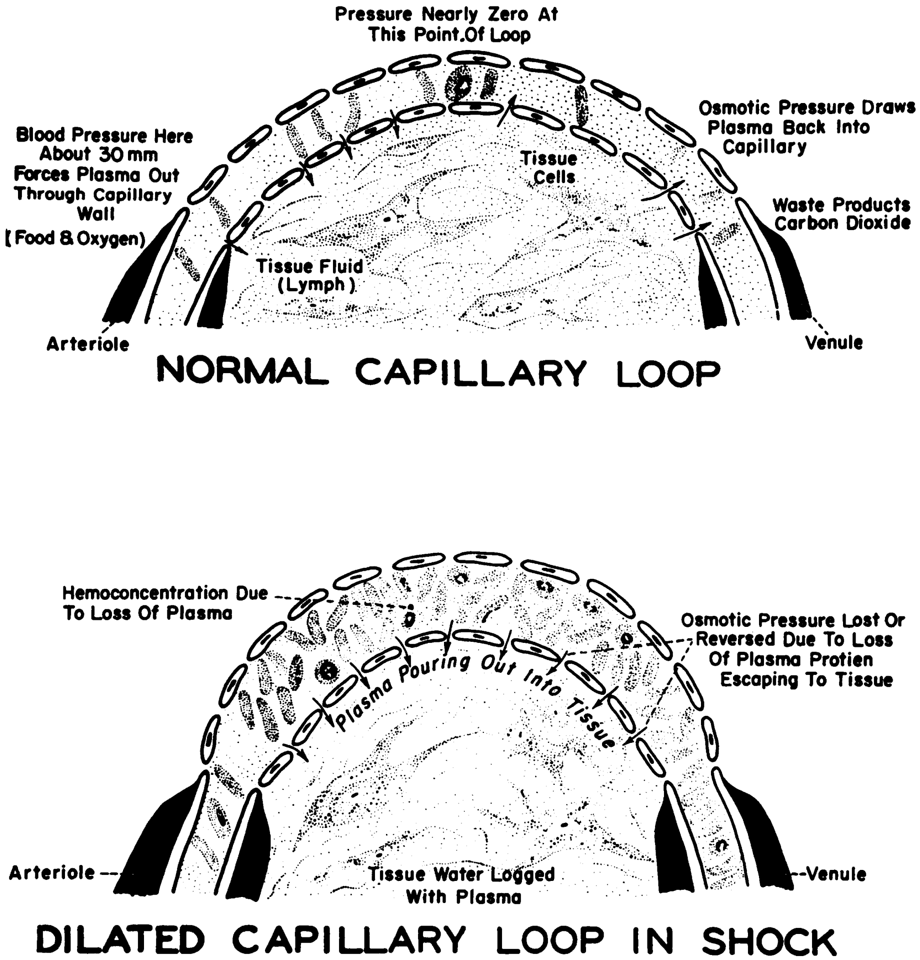


Figure 56. Capillary in shock.

(1) When tissue is injured, the blood vessels in the injured area dilate and fill with blood. If much tissue is injured, many vessels (capillaries) dilate, and a large part of the body's blood can be pooled into these relaxed capillaries. This reduces the amount of blood available to carry oxygen to the other tissues. Through the porous walls of the swollen capillaries, plasma leaks out into the injured tissues. Many capillaries leaking blood at the same time will result in a marked loss of circulating blood volume. If the injury is complicated by hemorrhage the rate of loss of circulating blood volume will be more rapid. The vascular system, with its vessels dilated and its blood volume reduced, now shows the early picture of shock (fig. 56). With the decreased effective circulating blood volume there is not enough blood to carry oxygen to uninjured tissues in other parts of the body. Therefore, these previously normal tissues now begin to show changes secondary to the lack of oxygen. Capillaries in these tissues dilate; thus stagnation of blood and the leakage of plasma begin in blood vessels all over the body. When this happens, the process is rapid and hopeless. Death follows.

(2) Besides the initial injury and hemorrhage, numerous factors may bring on shock or make it worse. These include severe pain, wound infection, disease, exposure to cold, fatigue, hunger and thirst, fear or worry, and unnecessary or rough handling of the patient.

157. Types of Shock

a. Psychogenic Shock. This type of shock results from sudden emotion, profound fear, or emotional reactions to disagreeable sights or tragic news. It may cause fainting, but the depressed state is temporary. Recovery is usually prompt, especially if the patient is placed in the supine position (on his back with face up).

b. Vasogenic Shock. This may be produced by the effects of such drugs as nitrites and histamine. In vasogenic shock, the capacity of the vascular system is enlarged but the amount of blood in the system is not changed.

c. Neurogenic Shock. This is caused by severe pain, fractures, injury to the brain or spinal cord, or spinal anesthesia. In neurogenic shock, the causative factors act directly on the nervous system. Heart output and blood pressure are reduced. Blood volume is not affected.

d. Cardiogenic Shock. This is produced when the heart, because of damage by injury or disease, is unable to pump adequate amounts of blood to all parts of the body.

e. Hemorrhagic Shock. This is shock caused by hemorrhage. Sudden loss of 15 to 25 percent of the total blood volume usually is

enough to produce hemorrhagic shock. Loss of 50 percent or more of the blood volume usually results in death.

f. Wound Shock. This is the type of shock seen most often on the battlefield or wherever severe injury occurs. Wound shock, or traumatic shock, is caused by wounding. The more severe the wound, the more severe the shock is likely to be. Wound shock is a combination of all the life-endangering factors that operate in neurogenic and hemorrhagic shock. It is brought on by severe hemorrhage, deep or widespread burns, crushing injuries, fractures, and other severe wounds.

158. Signs of Severe Shock

a. In fully developed wound shock the patient is pale. His skin is damp and cold all over. Sometimes the face has a grayish pallor and the skin of the hands and feet is marked by bluish discolorations. The blood pressure is low (systolic pressure 90 or below). The pulse is rapid and weak, or it may not be detectable at all. Respiration is rapid, irregular, and shallow. The eyes may have a vacant, dull expression, and the pupils are enlarged. If the patient is conscious, he is often listless and drowsy. He may be able to talk but his responses are sluggish. Occasionally, however, a patient in shock may appear alert and be talkative, restless, excitable, or even delirious.

b. Shock may develop slowly after an injury and not appear until several hours later. In incipient shock (shock that has not yet developed) none of the signs (*a* above) may be present. However, if a person is severely injured or has lost much blood, very often he will develop shock if he has not already done so. So, since severe injury and blood loss do result often in shock, their presence alone is reason enough for prompt, thorough treatment.

159. Treatment of Shock

a. Control of Bleeding. If hemorrhage is present, it must be stopped. Hemorrhage alone can cause severe shock or death.

b. Replacement of Fluids (fig. 57). Lost fluids should be replaced to restore an effective blood volume and to prevent dehydration.

(1) *Whole blood.* The best way to replace a deficit in blood volume is by transfusion of whole blood. For transfusion procedure, see paragraph 484. At an aid station, whole blood often is in short supply, but if it is available, a casualty may be given one unit (500 cc.) of blood before evacuation. Blood can be kept if stored at 4° to 6° Centigrade (39° to 43° Fahrenheit), but it is not safe to use after 21 days.

(2) *Plasma volume expanders.*

(*a*) *Dextran.* If whole blood is not available, dextran should be used. Dextran does not require cross-matching of blood types. It is easily stored and is stable at room tempera-

Figure 57. Replacing lost body fluids.

ture. Dextran, 6 percent in normal saline, comes in 250 cc. and 500 cc. plastic bags. It should be used until blood becomes available. However, a patient should not receive more than 2,500 cc. of dextran in 24 hours. Dextran is given intravenously. See paragraph 160 for use of a dextran infusion unit. Dextran should be started immediately on any casualty with a severe wound, before evacuation is attempted.

(*b*) *Serum albumin.* This is a plasma volume expander with limited usefulness. Concentrated serum albumin, 25 percent, comes in 100 cc. bottles. In ability to restore blood pressure, 100 cc. of serum albumin equals 500 cc. of dextran.

(*c*) *Plasma expander requirements.* The requirements for plasma expander therapy depend on the type of wound. See table IV for these requirements.

(3) *Dextrose.* Intravenous administration of dextrose (glucose) in solution is useful in preventing dehydration. Dextrose comes in various concentrations in distilled water (dextrose injection) and in normal saline (dextrose and sodium chloride injection). It is supplied in 1,000 cc. units for infusion.

(4) *Normal saline.* Normal saline solution (sodium chloride injection) may be used only if dextran and other plasma volume expanders are not available. It comes in 1,000 cc. units for infusion.

Table IV. Approximate Requirements for Plasma Expanders

Units (plasma expander)	Wound
1	Amputation or major open fracture of forearm or foot; 10 to 20 percent burn.
2	Amputation, open fracture, or major soft tissue wound of arm or calf; 20 to 30 percent burn.
3	Amputation, open fracture, or major soft tissue wound of buttocks or thigh; more than 30 percent burn.
1 or more	Wound of neck, chest or belly; any penetrating wound.

(5) *Oral fluids.* Casualties usually are thirsty but should not be given fluids by mouth because of the risk of vomiting. Oral administration of fluids, except for burn patients, should be left to the discretion of the medical officer. For fluid requirements of burn patients, see section X, this chapter.

c. Control of Pain. Pain can be relieved or controlled by several measures. Immobilize and splint fractures. Relieve severe pain with morphine as instructed in paragraph 155. Sedation with barbiturates may control restlessness. Handle the patient gently and avoid unnecessary movement either of the injured part of or the person himself.

d. Oxygen. Keep the patient's airway clear. If it is available, oxygen should be given to combat the anoxia (lack of oxygen in the tissues) that exists in shock.

e. Prevention of Exposure. Keep the patient warm but do not overheat him. Blankets are useful in cold weather but harmful in hot weather.

f. Position of Patient. Lay the patient on his back with his feet higher than his head, except in chest or head injuries. This is called the "shock position" (fig. 58). It aids the flow of blood back to the heart and brain. Where there is a chest or head injury, keep the patient level on his back; do not elevate the feet. If the patient is unconscious, keep him face down so that mucus and saliva drain out of the mouth instead of into the trachea.

160. How To Use Dextran Infusion Unit

The dextran infusion unit consists of a plastic bag, containing a sterile dextran solution, with two openings (closed, normally) and a tube with a needle adapter sheath in the end. The unit may be used as follows:

a. Roll up the casualty's sleeve and locate the desired vein in the arm. Select a large vein, preferably in the antecubital region (the bend of the elbow).

Figure 58. Shock position.

b. Above the venipuncture site, apply a tourniquet just tight enough to occlude venous flow. This will distend the veins and make it easier for you to insert the needle.

c. Take the sheath off the needle. If the unit does not have a needle attached to it, install a sterile infusion needle of the desired size. Be careful to touch only the hub of the needle.

d. Insert the needle into the vein, pointing in the direction of the course of the vein. You will know the needle is in the vein when blood flows back through the tubing.

e. Release the tourniquet. Fasten the needle in the vein by taping it to the arm.

f. Place the entire bag under the casualty's buttocks so that his weight creates pressure to force the fluid into the vein. Another way to allow flow of the fluid is to hang the bag above the casualty (fig. 57) and to open the air valve of the bag by pulling apart the two plastic tabs. The air valve is the one with a small steel ball in it.

g. When all the solution in the bag has been infused, withdraw the needle unless other medications are to be given intravenously.

Section V. INFECTION, ANTISEPSIS, AND STERILIZATION

161. Definitions

a. Contamination. The initial implanting or seeding of bacteria in a wound. All wounds except those produced under aseptic conditions are contaminated, for bacteria are universally present.

b. Infection. The state of being infected; the condition produced by the entrance into and multiplication within the body of pathogenic (disease-producing) microorganisms.

c. Septic. Affected by pathogenic microorganisms or their toxins.

d. Aseptic. Free from septic material or free from infection. *Aseptic technique* means technique that prevents bacteria and other pathogens from entering a wound.

e. Sterile. Aseptic; free from microorganisms.

f. Antisepsis. The prevention of sepsis by the destruction of microorganisms or by preventing and checking their growth and multiplication.

162. Signs and Symptoms of Infection

a. Discoloration of the area.

b. Heat, redness, and swelling around the wound.

c. Pain and sensitivity around the wound.

d. Formation of pus.

e. Red streaks radiating from the wound.

f. Swelling and tenderness of glands in the neck, armpit, or groin if infection is in the head, arm, or leg, respectively.

g. Fever, headache, and malaise (vague feeling of bodily discomfort).

163. Classification of Pathogenic Organisms

a. Bacteria. Bacteria are minute, one-celled organisms so small they can be seen only through a microscope which can magnify or enlarge them many times. Bacteria may occur alone or in large groups called colonies. Each bacterium is independent and may live and reproduce by itself.

b. Viruses. Viruses are protein bodies which are smaller than bacteria. They can multiply only in the presence of living cells. They cause measles, mumps, influenza, and certain other ailments.

c. Fungi. Fungi are simple plant organisms which are larger than bacteria. They most often attack the skin. They cause such infections as ringworm and athlete's foot.

d. Worms. A few kinds of worms can live inside the human body and cause disease. Hookworm, tapeworm, and pork worm are examples of these worms.

e. Protozoa. Protozoa are one-celled animals, a few of which cause illness in man. One of the most important diseases caused by protozoa is malaria.

164. Classification of Bacteria

a. Classification by Shape. Significant bacteria can be divided by their shape into two main groups. The groups are: the *cocci*, round or ball-shaped bacteria, and the *bacilli*, slender rod-shaped bacteria.

(1) *Cocci.* The cocci are characterized by formation of pus (pyogenic bacteria). Primary members of this groups are *staphylococci*, *streptococci*, and *diplococci.*

(*a*) Staphylococci group themselves in grapelike clusters. They form thick, yellow or white pus. They cause most boils, carbuncles, some infections of the fingers and hands, and "stitch abscesses" in surgical wounds. They can always be found on the normal skin.

(*b*) Streptococci arrange themselves in chains or beadlike formations. They form a thin, watery pus. Streptococci cause a type of infection that tends to spread. Common in the mouth and throat, they cause sore throat, cellulitis, and scarlet fever.

(*c*) Diplococci arrange themselves in pairs. They cause such infections as gonorrhea and meningococci meningitis.

(2) *Bacilli.* The bacilli which are most often seen as contaminants of wounds are—

(*a*) *Bacillus tetani*, a nonpus-producing bacillus which causes *tetanus* (lockjaw). It is found in the feces of horses, cows, and human beings and in soils infected with manure.

(*b*) *Bacillus welchii*, one of a group of bacilli which may infect dead or dying tissues. Such infections are characterized by the formation of gas and are called *gas gangrene.* These organisms are found in soils contaminated by human or animal waste.

(*c*) *Bacillus coli* forms a group of organisms which normally live in the human intestinal tract. This bacillus, which often contaminates intestinal wounds, produces light brown pus with a fecal odor.

(*d*) *Bacillus pyocyaneus*, a bacterium which produces greenish pus with a musty odor. It is a common secondary invader of chronic wounds already containing pus.

b. Classification by Oxygen Requirements. Bacteria are divided into two classes depending on their ability to live in the presence of free oxygen.

(1) *Aerobic* bacteria grow only in the presence of free air or oxygen. Most species of streptococci and staphylococci are aerobic.

(2) *Anaerobic* bacteria cannot live in the presence of free air or oxygen. *Bacillus tetani* and *bacillus welchii* are anaerobic. This is important in the prophylactic and definitive treatment of war wound infections. These organisms may penetrate any deeply contused, lacerated, or punctured wound. If the oxygen supply of these tissues is defective, serious infection will occur.

c. Classification by Ability To Injure. Not all bacteria are harmful. Many species of bacteria in the soil and the air cannot injure human beings. In addition, there are bacteria which are harmful to animals but not to man.

(1) *Pathogenic* organisms are those which can injure human beings. See paragraph 163 for types of pathogenic organisms.

(2) *Nonpathogenic* organisms are those which cannot harm human beings.

d. Classification by Spore Formation. Some bacteria can form spores. The spore of a bacterium is extremely resistant to sterilization. To kill it, high prolonged temperatures must be used. The spore forms must be killed in surgical sterilization for they can become active bacteria capable of causing severe infections. The most dangerous spore formers are tetanus bacilli and bacilli that cause gas gangrene.

165. Distribution of Bacteria

a. Bacteria flourish in moist surroundings at temperatures near that of the human body. Under less favorable conditions they may continue to exist, without multiplying, for a long time. All but spore-forming bacteria are usually destroyed by sunlight or by drying.

b. Bacteria are always present in air, water, and food and on man-made objects.

c. Certain varieties of bacteria, such as staphylococci and streptococci, are found on normally clean skin. Any wound of the skin surface, therefore, may be contaminated.

d. The mouth, tonsils, and throat harbor many types of bacteria, particularly streptococci. The intestinal tract, especially the colon, contains many bacteria, notably the coliform bacillus group and streptococci.

e. Well-manured farm land harbors the anaerobic bacilli of tetanus and gas gangrene.

f. Contamination may come from dust floating in the air or from droplets discharged from mouths and noses of people as they breathe. Thus, the possible sources of wound infection are almost countless.

166. How Bacteria Cause Infection

After entering the body, bacteria can cause infection either by their multiplication or by formation of toxins (poisonous waste products). A heavy inoculation of bacteria is harder to control than an inoculation by a few bacteria. Therefore, a heavily contaminated wound is apt to be complicated by a severe infection. There are various bacterial toxins. Some toxins destroy tissue, some dissolve blood cells, and some produce general toxic reaction in the body.

167. The Body's Defenses Against Bacteria

The body has four lines of defense to combat bacteria.

a. The first line of defense protects the body's surfaces. The skin acts like a wall to keep out most bacteria. Bacteria that enter the nose and mouth find another barrier. It is the mucous membrane that lines the respiratory and digestive systems. Cells of the membrane secrete mucus which entangles bacteria. Some cells of the membrane have cilia which sweep bacteria out of the body.

b. The second line of defense is formed by the white blood cells, or phagocytes. They engulf and destroy bacteria that pass through the first line of defense. This function of white cells, called *phagocytosis*, is described in paragraph 91.

c. The third line of defense is immunity. Previous encounters of the body with bacteria will produce a specific resistance or immunity to those particular organisms. This acquired immunity is associated with the formation of antibodies by the body. These antibodies interfere with bacterial invasion in several ways. They may neutralize bacterial toxins, may kill the bacteria, may make the bacteria more susceptible to attack by white blood cells, or may cause the bacteria to clot into little clumps which the white cells can destroy easily.

d. The fourth line of defense is the lymphatic system. Lymph cleans tissues, then flows through vessels into lymph nodes. The nodes act as filters for removal of bacteria.

e. In the healthy body, these defenses show a remarkable ability to fight off bacteria and to withstand their effects. However, such factors as injury, chilling, exposure, fatigue, and malnutrition lower the body's defenses. Most of these factors usually are present in battle casualties.

168. Wound Contamination and Infection

a. Contaminated Wounds. All wounds are assumed to be contaminated by bacteria when they come to the attention of medical service personnel.

b. Aseptic Wounds. The only wounds not considered contaminated are those made in an operating room under sterile (aseptic) conditions.

c. Infected Wounds. If undisturbed for the first 6 to 8 hours, a contaminated wound shows little change. After that time the bacteria begin to multiply, invade tissue beneath the wound, and give off their toxins. Within 24 hours an obvious infection may be present. Then the wound is called an *infected wound.* Usually the body's resistance is great enough to isolate the infectious process, and such a wound will heal, slowly filling in from the bottom and sides and giving off pus during the process. This is known as healing by secondary union (fig. 44). If the infectious process cannot be isolated by the body, it extends locally through the muscles and along muscle and tendon sheaths; it extends through the lymphatic vessels, perhaps through the lymph nodes and so into the general circulation. Such a spread of infection is accompanied by a severe, generalized toxic reaction. Then the patient is e tremely ill. If the bacteria get into the bloodstream, they are seeded throughout the body, producing a generalized septic condition that may result in death.

(1) There is always danger of infection in an open wound. Besides bacteria, an open wound may contain dirt, pieces of clothing, bone fragments, and other foreign matter that favors infection.

(2) Closed fractures of the hip or pelvic bones are considered dangerously infective because bony splinters may penetrate the intestine, allowing coliform bacteria to enter other body tissues.

169. Steps To Prevent or To Reduce Wound Infection

a. Cover open wounds with dry sterile dressings.

b. Wash minor cuts, bruises, and animal bites with soap and water.

c. Swab around minor wounds with an antiseptic, but *never put an antiseptic into an open wound.*

d. Avoid further injury, chilling, exposure, fatigue, or other factors that lower the body's resistance.

e. Give antibiotics (par. 184) and tetanus toxoid (par. 185) if needed.

f. Sterilize surgical instruments and supplies.

170. Sterilization

Sterilization is the complete destruction of micro-organisms. The methods of sterilization are physical and chemical.

a. Physical Agents Used in Sterilization. The physical agents used are temperature and radiation (ultraviolet light).

(1) *Temperature.* Bacteria can be killed by exposures to low and high temperatures. Resistance of bacteria to extremes of temperature depends upon the species of micro-organisms, the growth stage, and whether or not the micro-organisms

contain endospores. Spores have an enormously greater resistance than vegetative forms to high and low temperatures. This high resistance in spores probably is due to the concentrated, dehydrated state of the protoplasm they contain. Bacteria in a dry state withstand high temperatures longer than bacteria in a moist state. Low temperatures are much less destructive than are high temperatures. Heat may be used in various forms for sterilization. Moist heat may be applied as boiling water or as steam. Boiling water is used in the small instrument sterilizer shown in figure 59. Steam under pressure is used in the dressing and utensil sterilizer, or field autoclave, shown in figure 60. An autoclave is so built that steam enters the sterilizing chamber

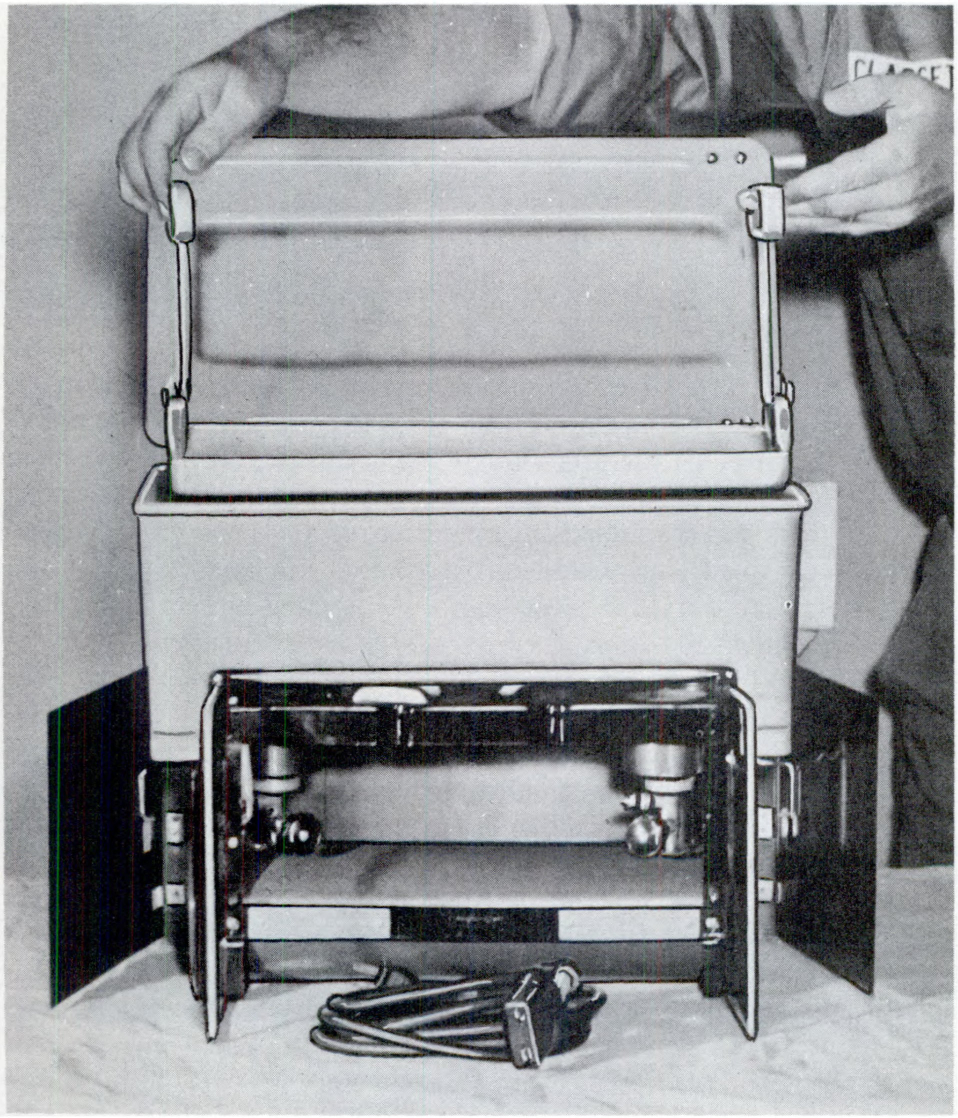


Figure 59. Instrument sterilizer, boiling type.

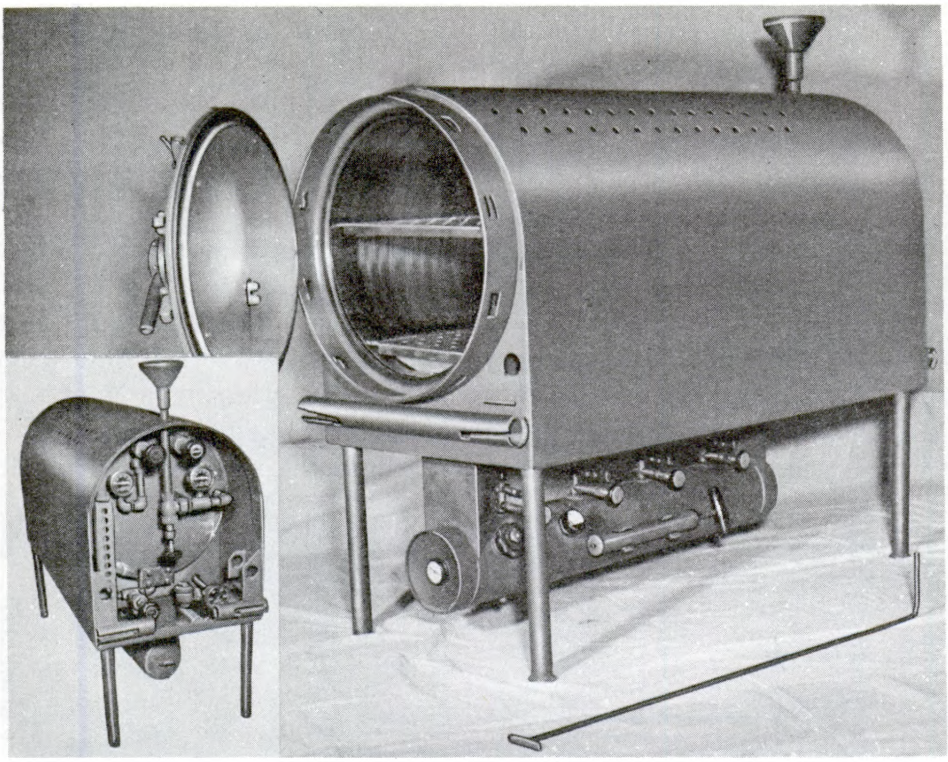


Figure 60. Field autoclave.

under pressure for the purpose of reaching high temperatures. The steam of the autoclave at high temperatures destroys all bacteria and spores. Autoclaving is the method of choice for sterilizing most surgical supplies. (Instructions for assembly and operation of the field autoclave are contained in a booklet that comes with it.) Needles and similar metallic objects can also be sterilized by being held in an open flame, such as the flame of an alcohol burner (fig. 61). See section XII, chapter 9, for more information on sterilization of supplies.

(2) *Radiation (ultraviolet light).* Radiation exerts its effects by a direct photochemical action upon bacteria exposed to it. In general, visible light acting upon bacteria exerts a fatal effect.

b. Chemical Agents Used in Sterilization. A disinfectant is a chemical agent used to destroy bacteria or other organisms by a chemical reaction. The reaction is subject to the individual peculiarities of the bacteria and to the influence exerted by physical forces upon both components of the reaction—the chemical agent and the bacteria. Different chemical agents act upon bacteria in different ways, stopping their growth or killing them by oxidation, coagulation, or other means.

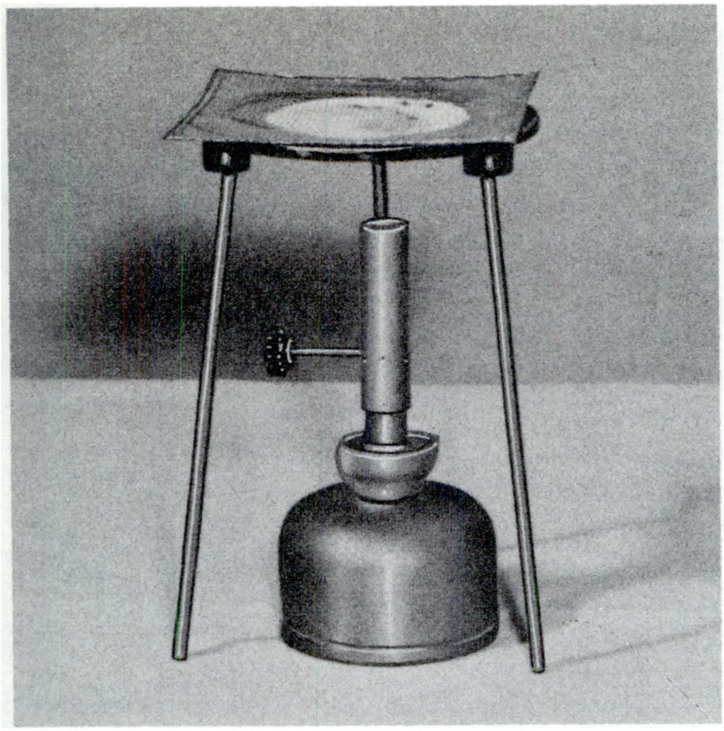


Figure 61. Alcohol lamp.

Section VI. DRESSINGS AND BANDAGES

171. Dressings

a. A dressing is a pad, compress, sponge, or any other material, manufactured or improvised, that is applied directly over a wound. Since it touches the wound, the dressing must be sterile or as nearly so as possible.

b. Dressings are used—

(1) To control hemorrhage.

(2) To cover a wound and keep out dirt and bacteria which might cause infection. Covering a wound also protects it from further injury.

(3) To absorb excess fluid from a wound.

(4) To maintain the temperature (local heat) around a wound.

(5) To apply medications.

c. Most dressings are made of gauze or of cotton wrapped in gauze. The dressing used most widely in the field is the first aid dressing. It is made in three sizes: small, medium, and large. These are sterile dressings, sealed in waterproof packages. The small first aid dressing, found in the individual first aid packet, is for treatment of small wounds. The medium first aid dressing is carried by aid men for emergency medical treatment. Large first aid dressings are for use in aid stations and clearing stations. These and other

field dressings, and their application to specific types of wounds, are described in FM 8-50.

172. Improvised Dressings

In emergencies, when sterile dressings are not available, wound dressings may be improvised from freshly laundered handkerchiefs, towels, sheets, or other cloth. If these materials are not to be found, take the cleanest cloth available and use it to cover the wound temporarily.

173. Rules for Applying Dressings

a. Cover the wound. Apply the dressing directly over the wound. Use a dressing that is large enough to cover the entire wound.

b. Avoid contaminating the wound. Use a sterile dressing. Do not touch the side of the dressing that goes next to the wound. Do not let the dressing touch your clothing or that of the casualty. Do not drag the dressing over skin around the wound. When tying the dressing, hold it in place so that it does not slip and rub dirt into the wound.

c. Whenever possible use the tails of the dressing as a bandage. If the tails will not cover it completely, use a bandage to hold the dressing in place. Be sure the bandage tails cover the edges of the dressing. This keeps the dressing from curling at the edges and letting dirt into the wound.

d. If the dressing is secured by tying, place the knots where they are easy to see and to reach. Never tie the knots over the wound. Use square knots when tying dressings and bandages.

e. After a dressing is applied, it should not be disturbed or replaced unless hemorrhage recurs or continues, or unless the dressing slips and exposes the wound.

174. Bandages

a. A bandage is any flexible material used—

(1) To hold a dressing in place over a wound.
(2) To fasten a splint to an injured part of the body.
(3) To create pressure over a wound for control of hemorrhage.
(4) To support (as a sling) an injured part.
(5) To supplement a dressing in protecting a wound from contamination.

b. Never apply a bandage directly over a wound. Put a sterile dressing on first, then cover it with a bandage. The bandage may not be sterile; thus, it would contaminate the wound. Other rules to follow in bandaging are—

(1) Apply bandages evenly and firmly but not too tightly. A bandage that is loose may slip off entirely or may not hold the dressing in place. A bandage that is too tight may cut off circulation of blood in the injured part.

(2) When bandaging an arm or a leg, start below the wound and work upward. Unless the fingers and toes are injured leave them exposed so they can be watched for signs of impaired circulation.

(3) Locate the knots of bandages where they are easy to reach and where they will not cause discomfort.

(4) Once a bandage has been applied, look at it frequently to see if it is secure. If it is too loose or too tight, reapply the bandage.

c. There are two common types of bandages—

(1) Triangular bandages.

(2) Roller bandages.

175. Triangular Bandages

The triangular bandage is a triangular shaped piece of muslin cloth. It may be used as such or it may be folded into a cravat (fig. 62). A common use of the triangular bandage is in making a sling for the support of injuries of the arm or shoulder (fig. 63). It may also be used to hold dressings in place or to immobilize parts of the body (fig. 85).

176. Roller Bandages

Roller bandages may be made of gauze, flannel, muslin, elastic webbing, or rubber. They are usually several yards long and 1 to 6 or 8 inches wide. The sizes commonly used are 2 inches wide and 6 yards long for hand, finger, and toe bandages; 3 inches wide and 10 yards long for arm, leg, and head; 4 inches wide and 10

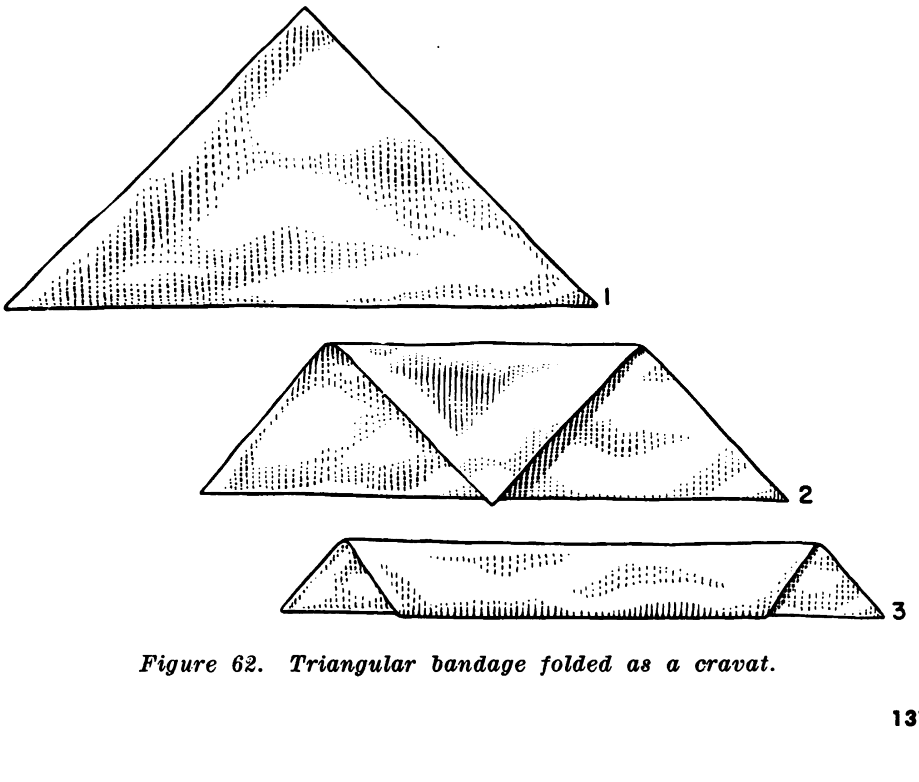


Figure 62. Triangular bandage folded as a cravat.

yards long for thigh, groin, and trunk. If the principles illustrated (figs. 64 through 70) are understood, the application of roller bandages is simple. For details of bandaging and splinting, see FM 8–50.

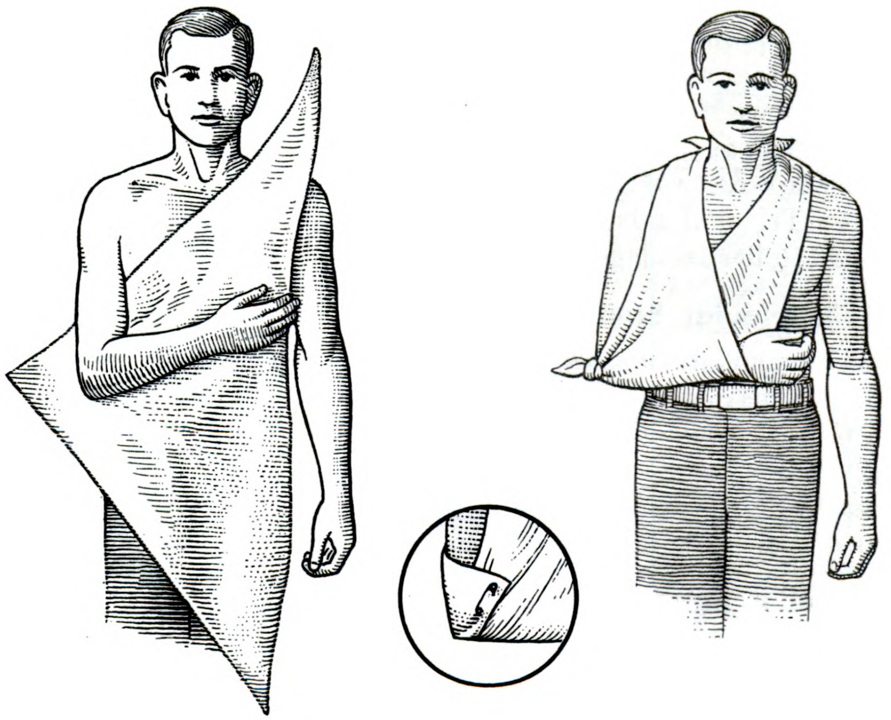


Figure 63. Triangular bandage as a sling.

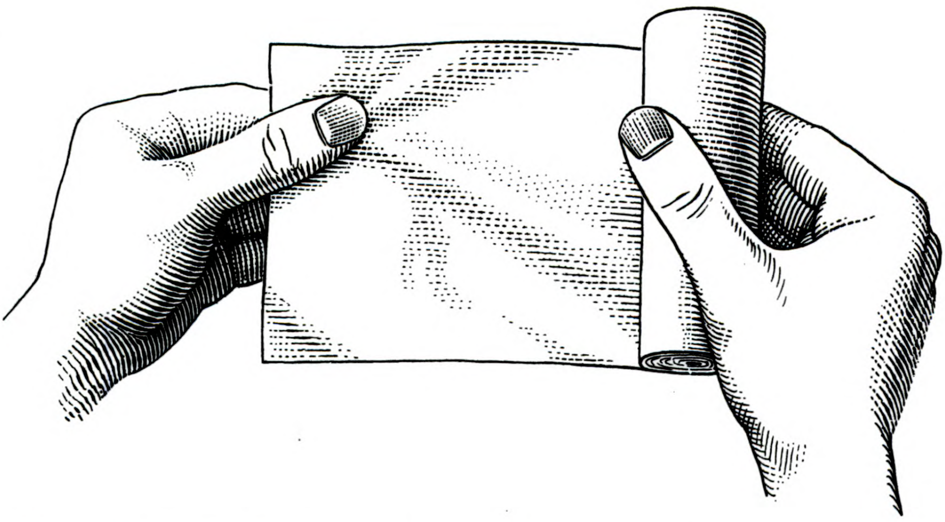


Figure 64. Starting roller bandage. (Hold roll in right hand, loose end on bottom.)

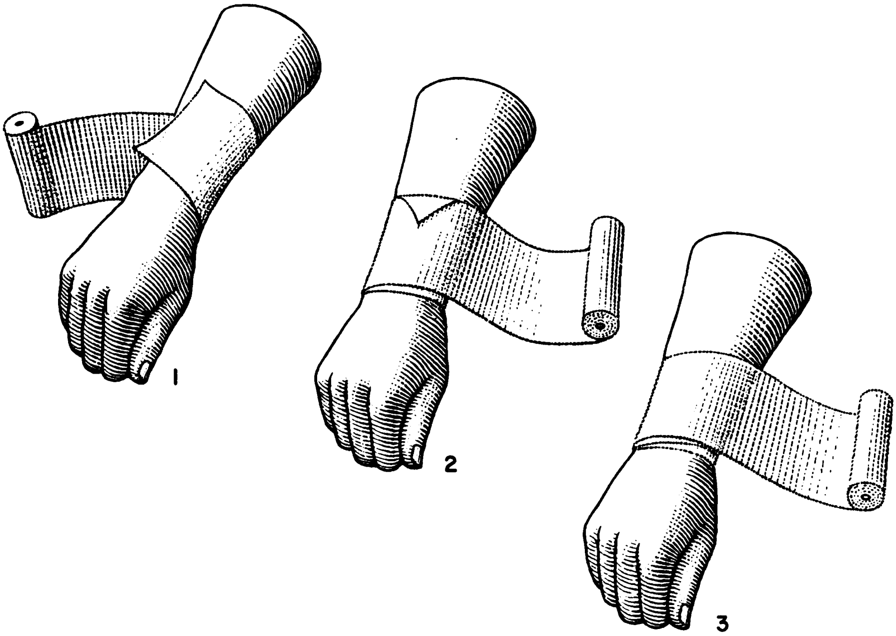


Figure 65. Anchoring roller bandage. (Make a few turns in the same spot.)

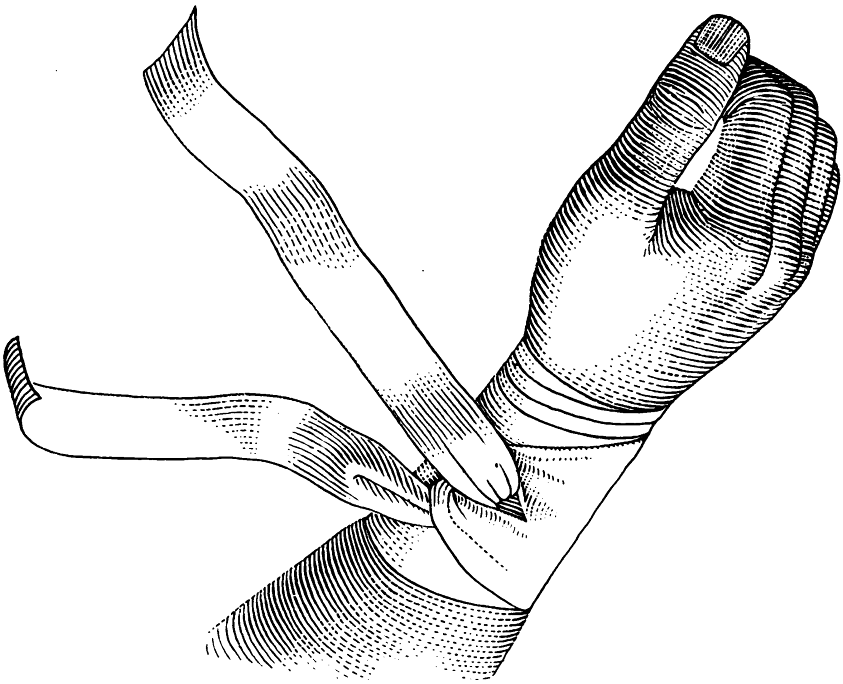


Figure 66. Fastening roller bandage. (Tear end into two tails, tie in a knot, carry one tail in opposite direction and tie.)

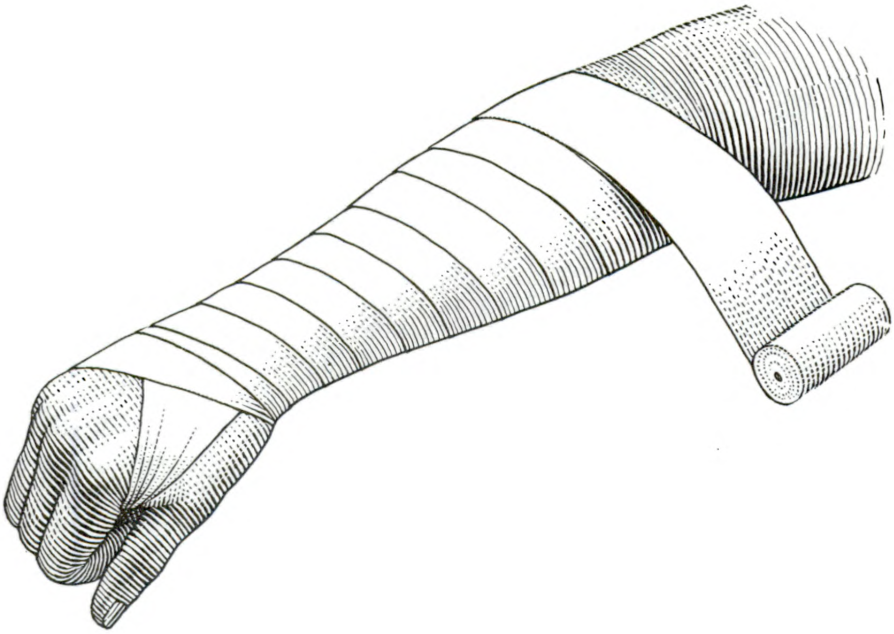


Figure 67. Simple spiral bandage. (Use in bandaging cylindrical parts; overlap each turn one-third.)

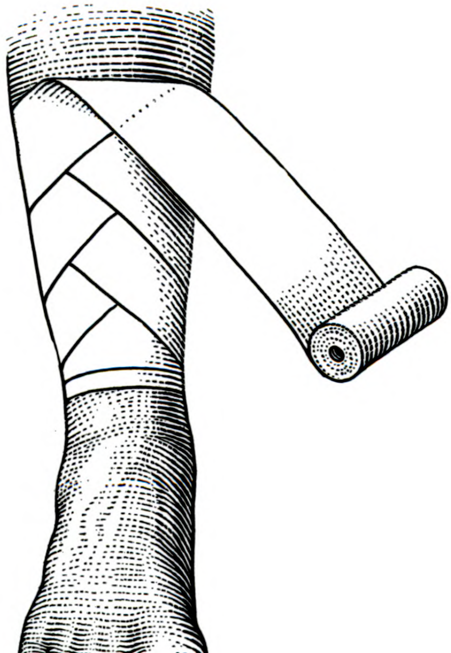


Figure 68. Spiral reverse bandage. (Use in bandaging tapering parts; overlap each turn one-third.)

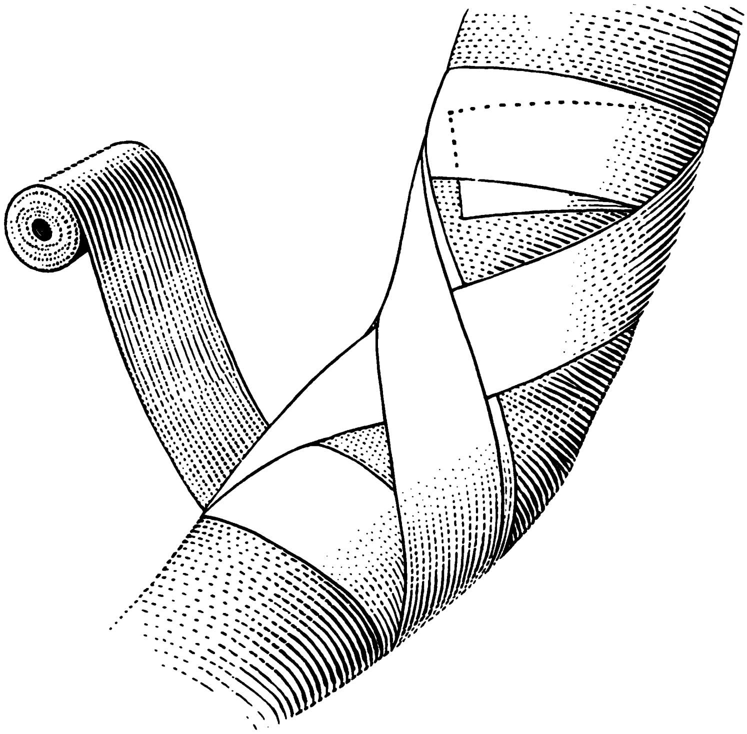


Figure 69. Figure-of-eight bandage. (**Use in bandaging joints.**)

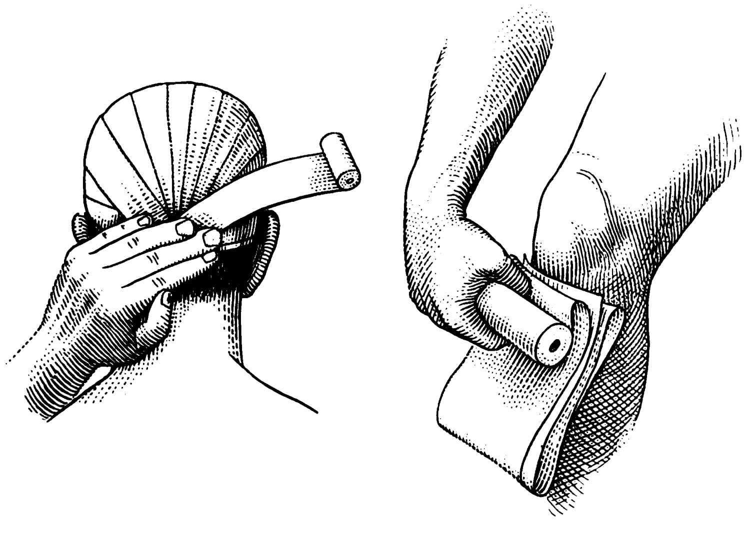


Figure 70. Recurrent bandage. (**Use in bandaging head, end of finger, stumps, and the like.**)

Section VII. FRACTURES

177. Description

A fracture is a break in the continuity of a bone. It is not necessary for the fragments to be separated. In many fractures the bone may only be "cracked." Fractures are generally classified as closed or open. A fracture is *closed*, if there is a break in the bone without a break in the exterior surface of the skin. A fracture is *open* if the break in the bone communicates directly with the exterior surface of the skin. A bone fragment may stick out through the skin, or the bone may be exposed through a wound channel such as one produced by a shell fragment or bullet. The latter is the type commonly seen in battle casualties. Open fractures are more serious than closed fractures. There is more bleeding in an open fracture as well as more damage to nerves, muscles, and blood vessels. There is also danger of infection and shock. Yet the mortality rate from this type of fracture is low if these casualties are given prompt treatment and proper measures are taken to prevent shock and infection.

178. Classification of Fractures

Fractures are further classified by position, number of fragments, and direction of fracture line (fig. 71), as follows:

a. Transverse. A fracture, usually in a straight line, more or less at right angles to the long axis of the bone.

b. Spiral. There are two fragments, but the fracture line is spiral or S-shaped. These fractures are caused by twisting injuries of the type seen among ski troops, or by torsion produced by muscular contraction.

c. Serrated. Two fragments with saw-tooth edges along the fracture line.

d. Comminuted. Three or more fragments resulting from the fracture.

e. Impacted. The broken ends are jammed together so that they more or less telescope into each other.

f. Greenstick. The bone is not broken completely through.

g. Oblique. Fracture line extends diagonally across the bone.

h. Longitudinal. Fracture line splits the bone lengthwise.

i. Multiple. Bone is fractured at more than one place.

j. Depressed. This type of fracture occurs in flat bones such as the skull. A fragment is driven below the surface of the bone.

k. Pathological. These are fractures due to a disease process which causes a gradual weakening within the bone. Parathyroid disease, syphilis, bone tumors, and other diseases can weaken a bone so that only slight stress is needed to fracture it.

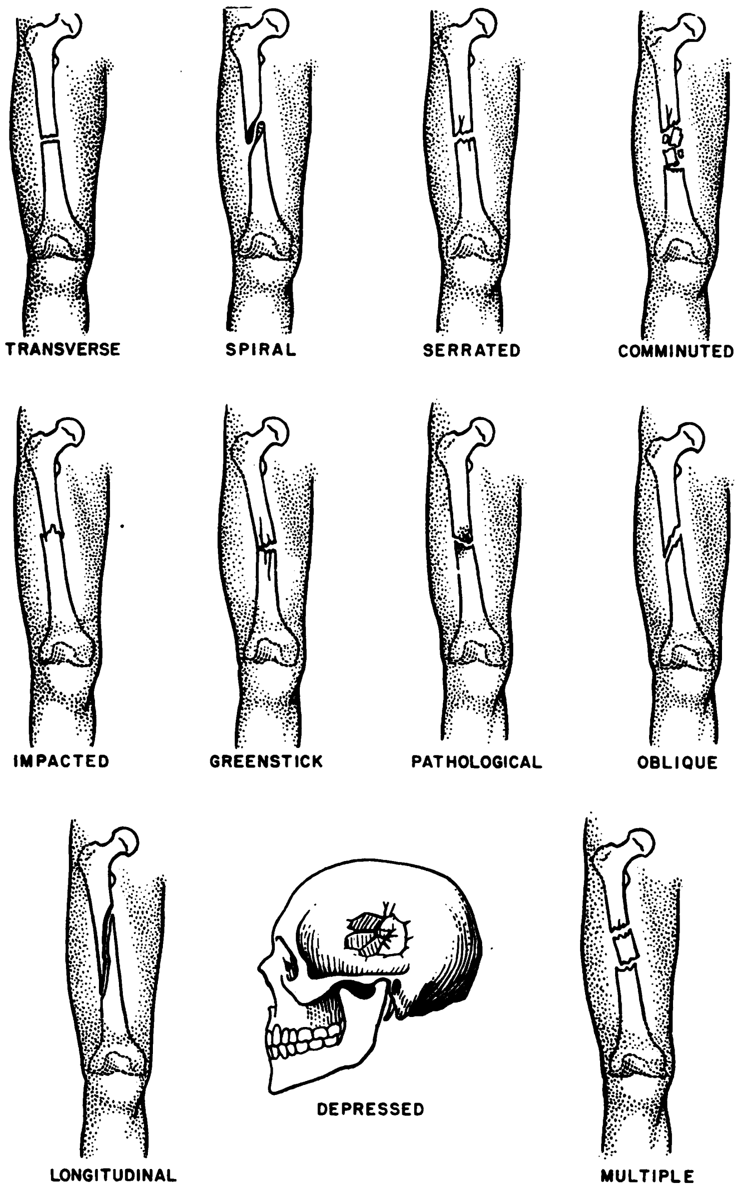


Figure 71. Types of fractures.

l. Complicated. Any fracture present with injury to other structures such as nerves, arteries, or internal organs.

179. Diagnosis of Fractures

X-ray examination (fig. 72) is often the only way to get definite proof of fractures. An X-ray examination should be made of all injuries in which a fracture is a possible diagnosis. However, until X-ray can confirm or deny it, a fracture should be suspected and the patient treated accordingly if one or more of the following symptoms is present:

a. The patient feels or hears the bone snap.

b. Pain at the point of the break.

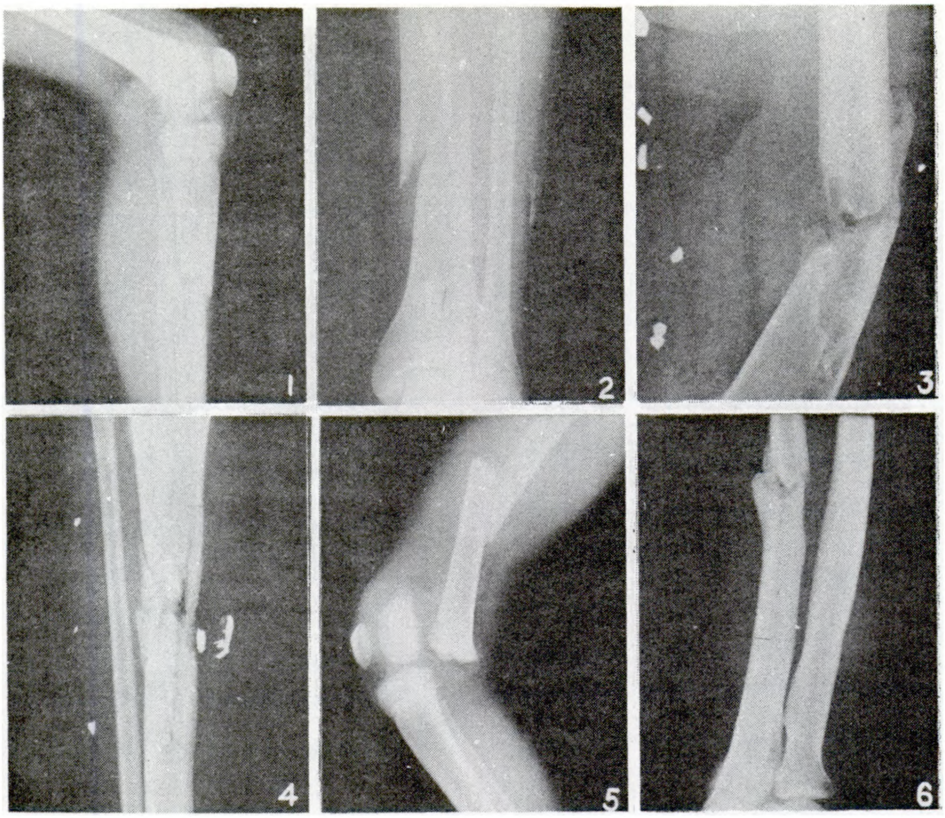


Figure 72. X-rays of fractures.

c. Partial or complete loss of motion in adjacent joints.

d. Deformity of the part. The arm or leg may be in an unnatural position, or bent where there is no joint. The chest wall may be caved in.

e. Tenderness over the site of the break. The tenderness is sharply localized. The point of tenderness can be located by *gently* pressing along the bone with the end of the finger. This is known as "point tenderness" and is a valuable sign.

f. Swelling and discoloration.

g. Sometimes a grating sensation, called "crepitus," can be felt as broken ends of the bone rub together. Do *not* attempt to obtain this sign. Grating of the bones together is painful and causes further damage and shock.

h. Abnormal movement at the site of fracture.

i. Appearance of fragments. In open fracture a bone fragment may stick out through the skin, or there may be a wound channel extending down to the bone.

180. Symptoms in Special Types of Fractures

Any or all of the symptoms listed for the following types of fracture may be present:

a. Fracture of the Skull. Unconsciousness, swelling or laceration of scalp; bleeding or leakage of spinal fluid from nose, mouth or ears; difference in size of pupils; blackening of tissues under the eyes; changes in pulse and respiration; and paralysis or twitching of muscles.

b. Fracture of the Spine. Pain, tenderness, or deformity at the site of fracture. If the spinal cord is injured, there may be paralysis or loss of sensation below the site of the fracture. There may be loss of control of bladder and bowel.

c. Fracture of the Lower Jaw. There may be pain on movement of jaw; irregularity of teeth; inability to swallow or talk in some cases; and bleeding and drooling of saliva from the mouth. In cases of bilateral fracture, the soft tissues may drop back and strangle the patient. (One of the most important phases of treatment is to clear the upper air passages by airway or traction on the jaw.)

d. Fracture of the Clavicle. The injured shoulder is at a lower level than the uninjured one. The patient is unable to raise arm above the shoulder and he supports the elbow of the involved side with the opposite hand. Fractured ends can usually be felt under the skin.

e. Fracture of Rib. Pain, especially on breathing or coughing. The broken rib is tender and hand pressure over the sternum produces pain at the site of the fracture. The break can sometimes be felt. The patient usually holds his hand tightly over the break. If the lung is punctured, he may cough up bright red frothy blood.

f. Fracture of the Pelvis. Fractures of the pelvis are produced by direct violence such as falls from a height, automobile accidents, and crushing injuries. Symptoms of fracture of the pelvis are that the patient is unable to stand or walk, complains of pain in the pelvic region, or passes blood in the urine (evidence of bladder injury). First consideration with fractures of the pelvis, particularly when the fragments are displaced, concerns not the fractures but the adjacent soft tissues which may have been injured—the bladder, urethra, intestines, or the blood vessels.

181. Healing of Fractures
(fig. 73)

a. When a bone breaks, there is always an injury to the periosteum (the membrane that covers the bone) and to the surrounding tissues. There is also hemorrhage about the ends of the fragments, and the space between the two fragments rapidly becomes filled with a blood clot. This blood clot is invaded by cells which form granulation tissue as described in paragraph 147. This forms a union of fibrous tissue between the ends of the bone which is known as a *soft*

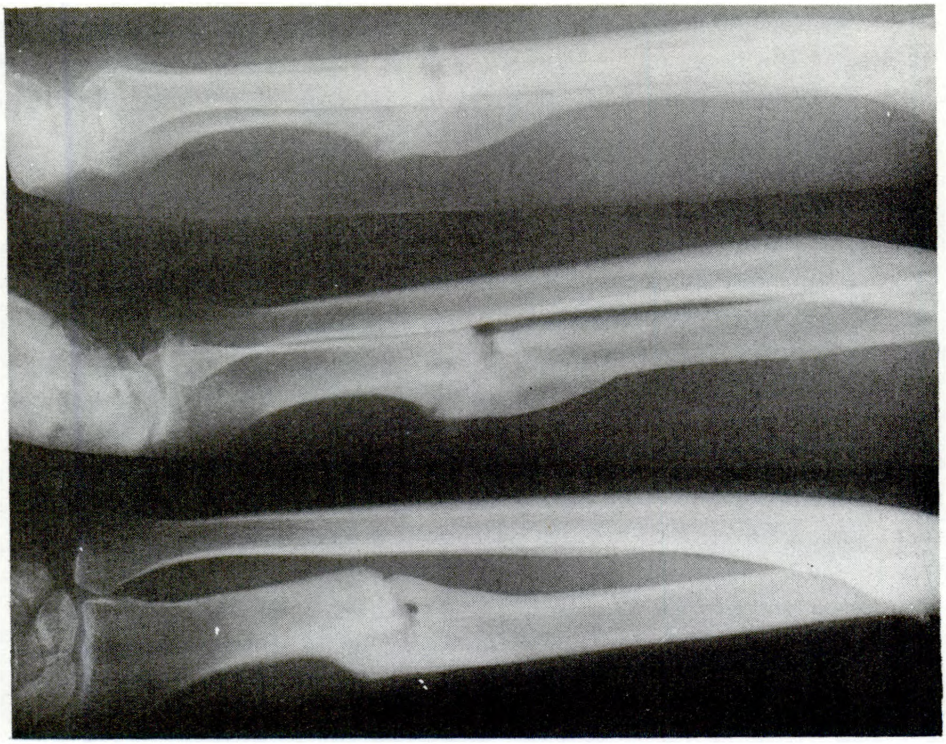


Figure 73. X-ray of a healed fracture (three views taken from different angles).

callus. Then bone-forming cells begin growing in from the periosteum. If the periosteum has been torn away or killed, these cells are not present. They gradually form the soft callus into *hard callus*, making a firm bony union between the broken ends of the bone. In treatment of fractures, the bones are immobilized until X-ray shows that a hard callus has been formed.

b. Many conditions can interfere with the proper healing of a fracture.

(1) *Poor blood supply.* If one of the parts of the broken bone is not supplied by blood, that part may die and union will not take place. This is prone to occur in the neck of the femur, the patella, the elbow end of the radius, and several other places where circulation is poor.

(2) *Poor immobilization.* If the fracture is not properly splinted and motion continually takes place at the site of fracture, the bony union will not take place.

(3) *Infection.* If the fracture site becomes and remains infected, union will not take place. There is great danger of this occurring in open fractures because infection takes place through the open wound.

(4) *Interposition of soft parts.* If a piece of muscle or other tissue gets between the ends of the broken bone, bony union cannot take place.

(5) *Dietary deficiency.* If the diet of the patient does not include enough calcium or other minerals, new bone cannot be formed.

(6) *Pathological fractures.* In pathological fractures (par. 178*k*), the disease of the bone may impede or prevent union.

182. Emergency Treatment of Fractures

a. General Procedure.

(1) Splint all fractures "where they lie" before moving the patient. Apply traction if indicated.

(2) Stop hemorrhage and apply sterile dressings to open wounds. Follow the measures described under wound treatment (pars. 148 to 152 inclusive).

(3) Treat for shock.

(4) Give morphine if pain is severe.

(5) Avoid unnecessary handling of the injured part. When lifting an injured limb, always support it under the break and at points above and below the break.

(6) Place patient on litter and secure the injured part enough to keep it from moving while the litter is transported. Dress the litter properly to conserve the patient's body heat.

(7) Evacuate the patient as soon as possible. Evacuation is especially important in cases of open fractures, for these require prompt surgical cleaning (debridement).

b. Splinting. Follow these general principles in applying splints. For details, see FM 8–50.

(1) The splint should immobilize the joint above and below the fracture. Thus for a fracture of the tibia, the knee and ankle joint should be immobilized.

(2) The splint should be padded to prevent injury to the limb or discomfort to the patient.

(3) The splint should be so applied that it does not interfere with the blood supply of the splinted part.

(4) Traction is required for most fractures of long bones to maintain the fractured ends of the bone in position (fig. 74).

(5) Splints can be improvised from boards or sticks padded with cloth, pieces of shirt, or other fabric (figs. 75 through 77). Rifles, bayonets, rolled magazines and newspapers may also be used. When hard objects are used as splints they should be padded before they are placed against the injured part. The purpose of splinting is to immobilize the fragments of broken bone. Be sure the splint does this in all cases.

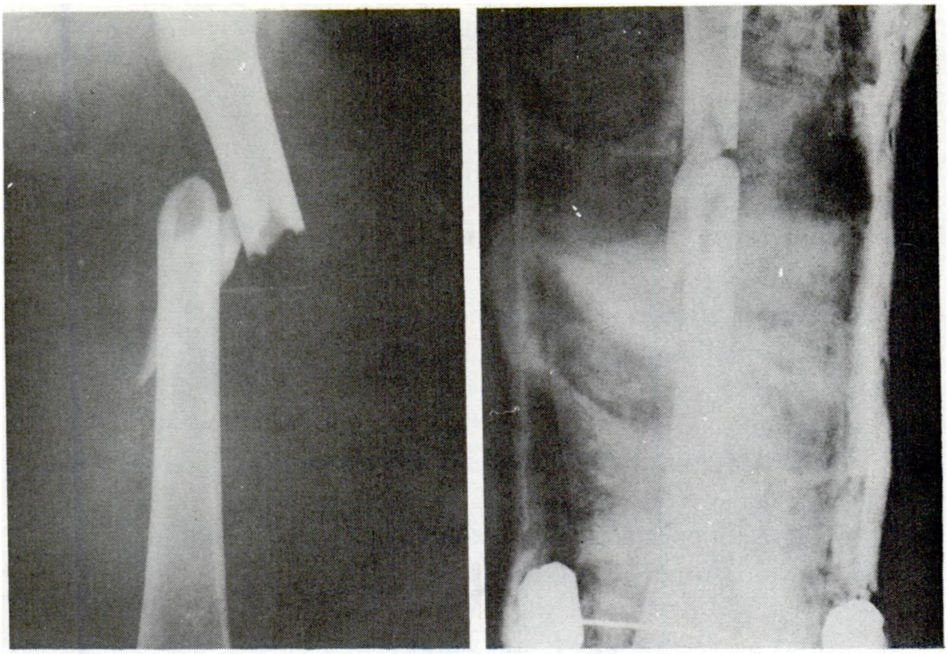


Figure 74. Effect of traction on fracture of femur.

Figure 75. Sticks rolled in cloth to form improvised splint for forearm.

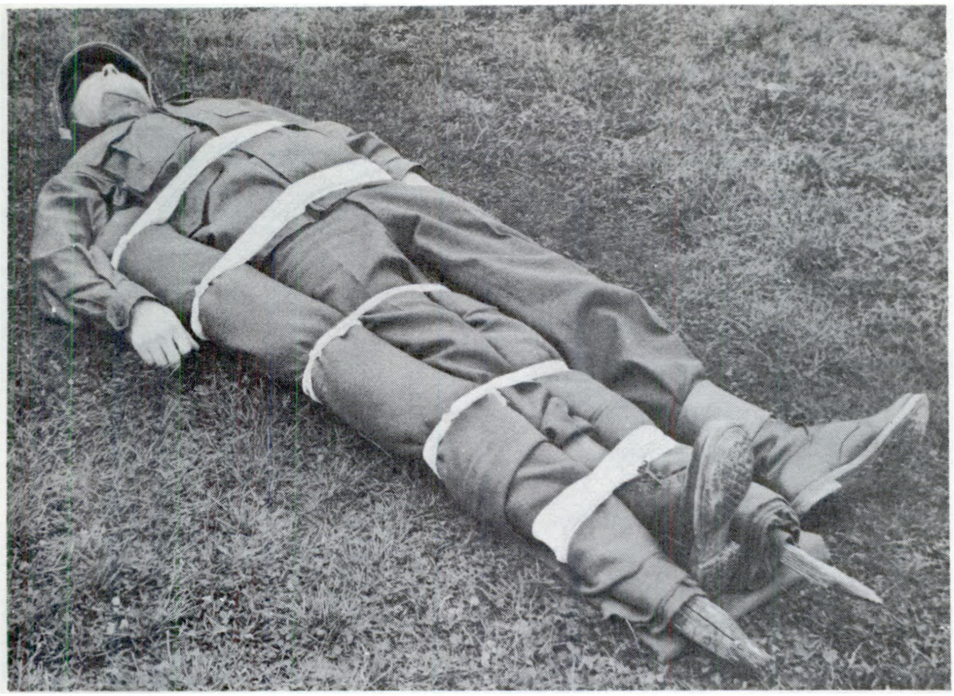


Figure 76. Sticks rolled in blankets to form improvised splint for leg.

Figure 77. Undamaged leg used to form improvised splint for fractured leg.

183. Treatment for Specific Types of Fractures

a. Fracture of the Femur (thigh) and Tibia (leg). Fractures of the femur and tibia, except the distal third of the tibia, are best immobilized in the Thomas leg splint (fig. 78) as described in FM 8–50.

b. Fractures of the Ankle and Foot. Fractures of the distal third of the tibia, the ankle, and the foot are immobilized in the padded wire ladder splint (fig. 79).

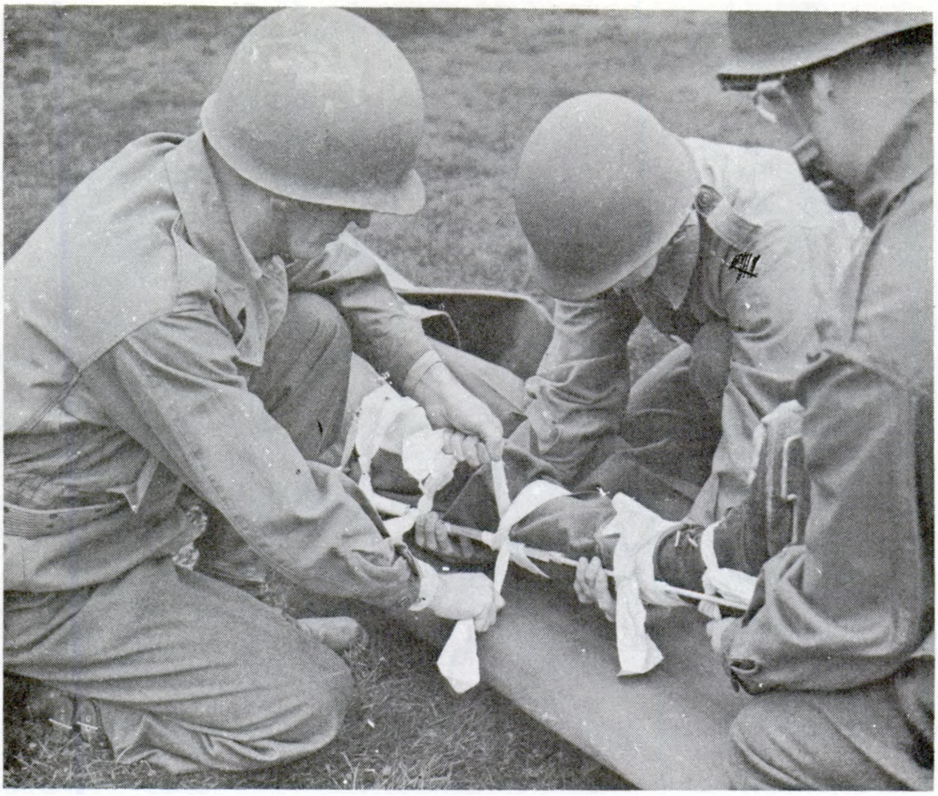


Figure 78. Thomas leg splint.

c. Fractures of the Humerus. These are immobilized by placing a one-piece padded splint along the arm from shoulder to elbow, supporting the arm in a sling, and binding the arm to the chest with triangular bandages (fig. 80).

d. Fractures of the Forearm, Wrist, or Hand. These are immobilized by padded basswood splints extending from elbow to just beyond the finger tips. Apply one splint to inner side of the arm, another splint to outer side of the forearm and hand. Secure splints with cravat or roller bandages. Support arm in sling. The wire ladder splint may also be used.

e. Fractures of the Elbow. If the arm is bent at the elbow, the fracture should be immobilized in a padded wire ladder splint bent at a 90° angle (fig. 81) and the arm supported in a sling (fig. 82). If the arm cannot be bent, apply a padded splint from the axilla to the wrist.

f. Fractures of the Spine. Spinal fractures must be treated with great care because of the danger of injury to the spinal cord. Do not bend the spine. If the spine is bent, broken vertebrae can injure the spinal cord. Injury to the spinal cord can cause paralysis of the body or death. Do not move the patient, even if he is only suspected of having a fractured spine, until a litter or an improvised litter is available. In moving the patient, lift him gently onto the

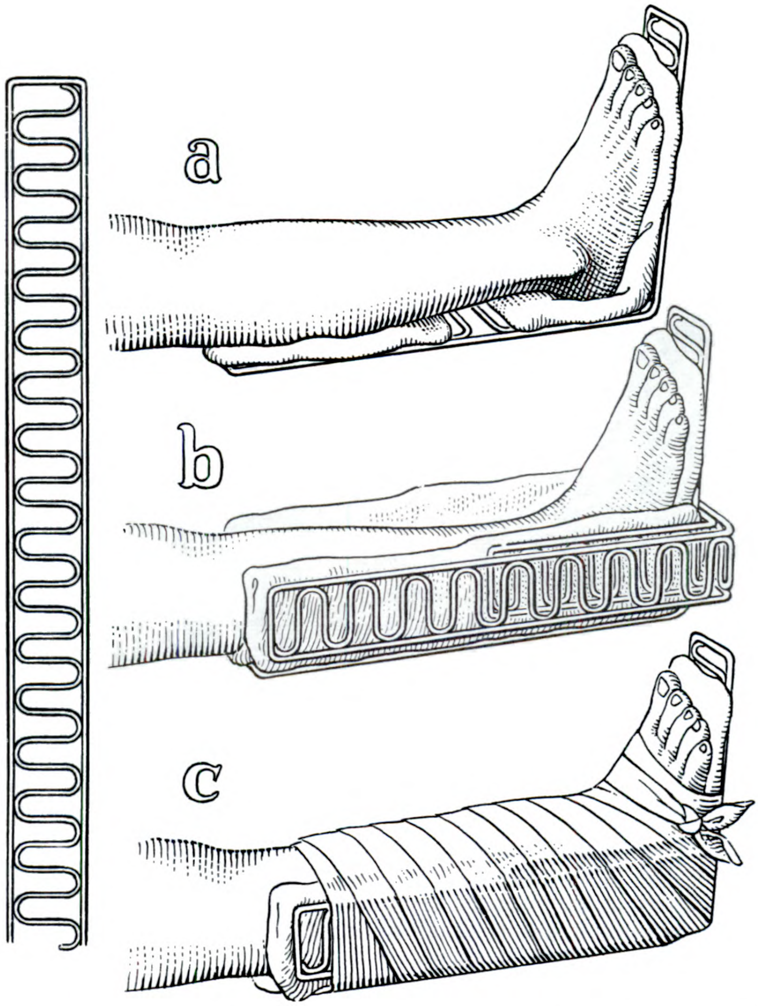


Figure 79. Application of padded wire ladder splint for fractured foot or ankle.

litter, keeping his body alignment straight, without bending any part. It is best to have four men to lift the patient. One man should support the patient's head and keep it straight while the others lift him. A blanket or similar material should be made into a roll about 4 inches thick and about 2 feet long. If the patient is put face down on the litter, place the roll crosswise to support the chest. If the patient is put on the litter in supine (flat on his back, face up) position, place the roll crosswise under the small of the back (fig. 83). FM 8–50 contains detailed instructions for transportation of patient with fractured spine.

g. Fractures of the Neck (cervical spine). Fractures of the neck, like other spinal fractures, must be treated carefully to avoid injury to the spinal cord. These fractures are immobilized by a high collar around the neck. The collar tends to lengthen the neck and raise the chin so as to arch the neck backwards. A simple collar can be made from an artillery shell container (fig. 84). Cut the cardboard cylin-

Figure 80. Fracture of the humerus immobilized by binding to the chest wall.

der into a collar about 5 inches high. Split it on one side, pull it apart, and place it around the neck. Fasten the collar with adhesive tape. A similar collar splint can be made from a well-padded cartridge belt or by wrapping a folded newspaper, shirt, or jacket around the neck. Another way to keep the head and neck motionless is by placing padded stones or packs at each side of the head as support, with a rolled blanket under the neck. Raise the shoulders to put the roll under neck; do not twist or raise the head. When a patient with a broken neck is moved, his neck must not be bent or twisted. One person alone should never attempt to move such a patient. This must be done as a coordinated effort of at least two persons, so that the patient's head and neck are kept in line with the rest of his body. One person should steady the head and neck while the other moves the patient. See FM 8–50 for details on movement of patient with a fractured neck.

h. Fractures of the Skull. These fractures do not require splinting. The patient should be kept lying down, on his back. When the patient is moved, keep him flat on his back on the litter. Do not give

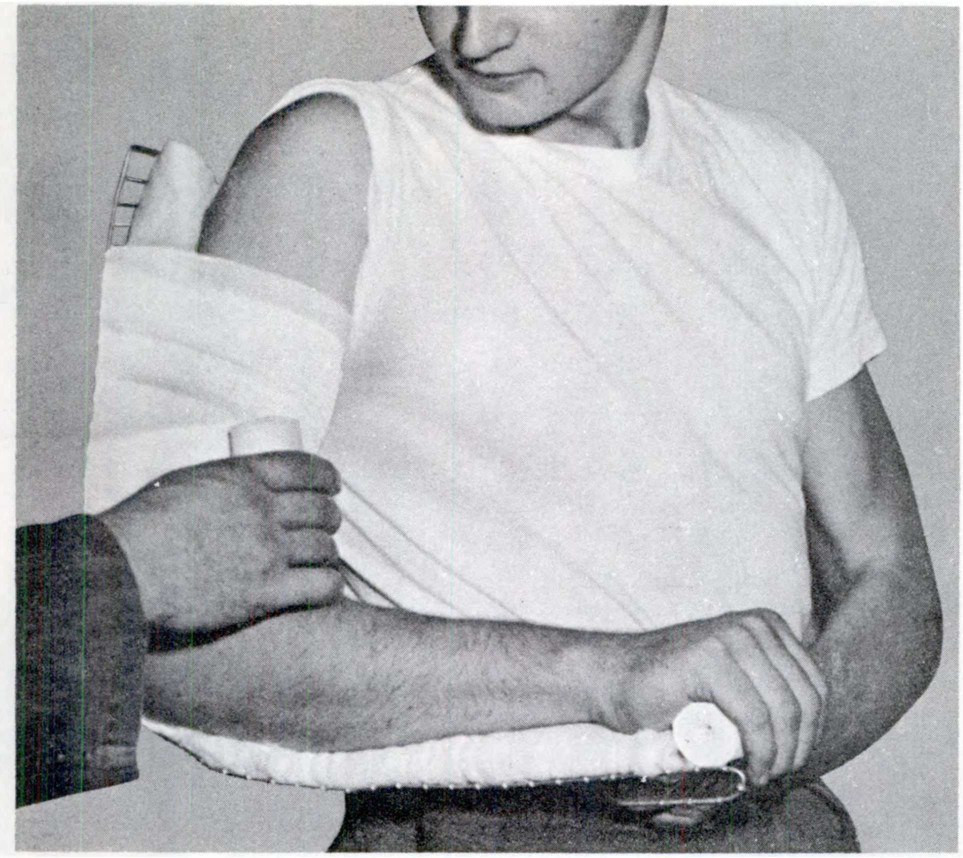


Figure 81. Wire ladder splint applied to fractured elbow.

morphine. Cover any open head wound with a sterile dressing and hold it in place loosely with a bandage. See paragraph 190 for special treatment required for skull fractures.

i. Fractures of the Jaw. Emergency treatment of these fractures includes not only immobilization of the parts but control of hemorrhage, maintenance of airway for breathing, and treatment for shock. Special treatment for fractures and other wounds of the jaw is described in paragraph 191.

j. Fractures of the Pelvis. These fractures usually do not require splinting. Two belts or a bandage tied completely around the waist (pelvis) helps to immobilize the fracture. A complication of fractures of the pelvis is rupture of the urethra or bladder, one of whose signs is bloody urine. This condition is a surgical emergency and the patient should be taken to a hospital as soon as possible. The patient should be evacuated on a litter and in a supine position.

k. Fractures of the Ribs. It is impossible to splint these fractures, but the pain can be relieved by restricting the movement of injured ribs. This is done by binding a tight swathe of muslin bandage around the chest or by applying three triangular bandages, folded as cravats, around the chest (fig. 85). These are applied when the pa-

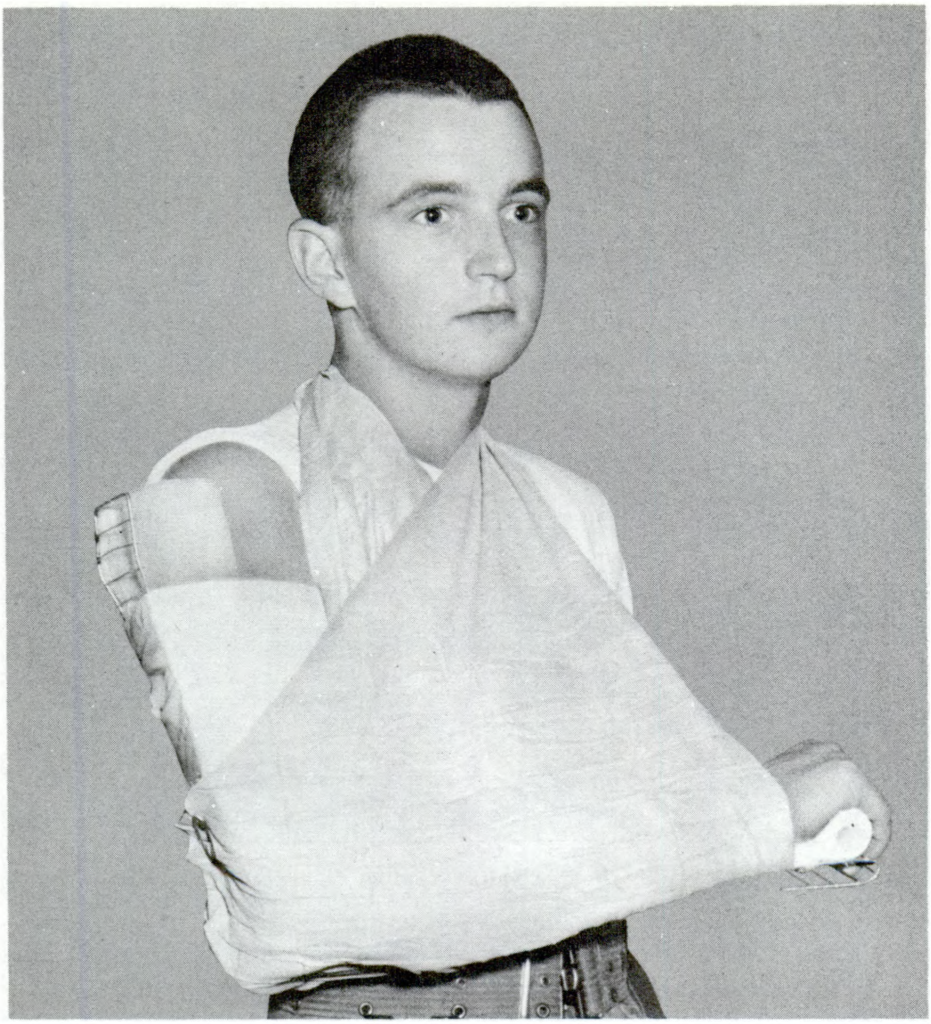


Figure 82. Fractured elbow supported in wire ladder splint and sling.

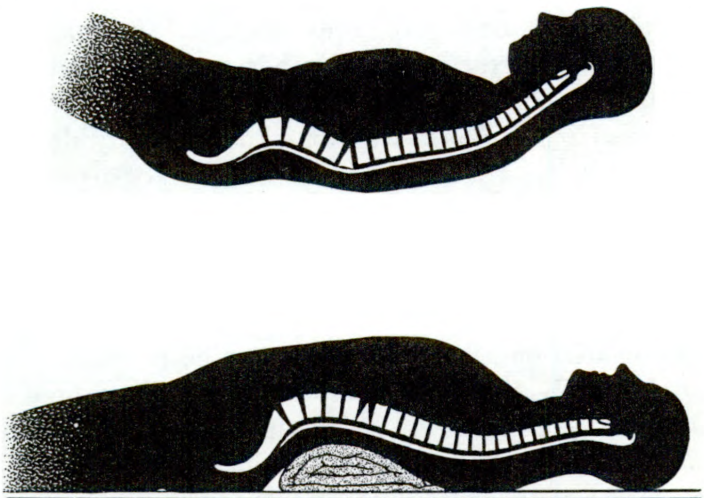


Figure 83. Effect of placing a blanket roll under a fractured spine.

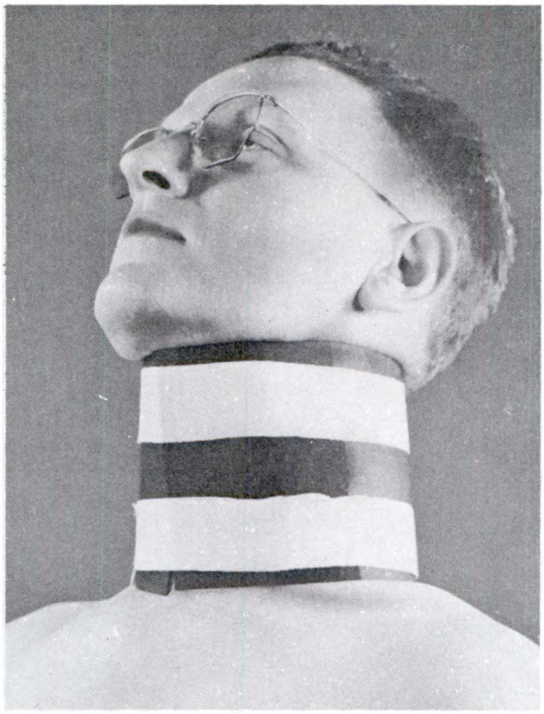


Figure 84. Shell container used to splint a broken neck.

tient has forcefully exhaled the air from his lungs. Bandages are applied tightly enough to give support but not so tightly that the rib may pierce the lung. However, the application of adhesive tape to the chest is more effective than the use of bandages. Apply tape in the following manner: Shave the hair from the side of the chest involved. Ask the patient to take a deep breath and then to exhale forcefully. Upon exhalation apply the tape; place one end over the spine and bring the other end around the chest and across the sternum in front (fig. 86). The tape should be anchored front and back, well beyond the midline on the uninjured side.

l. Fractures of the Clavicle. When the clavicle (collarbone) is fractured, the break is easy to detect. The shoulder on the injured side droops, bending the broken ends of bone upward and causing a noticeable deformity. The arm on the injured side cannot be raised and the patient usually supports it at the elbow with the opposite hand. Point tenderness and sometimes a subcutaneous hematoma are present with the deformity. The injured part is immobilized temporarily by—

(1) Supporting the arm in a triangular bandage sling, holding the arm slightly higher than the elbow or

(2) Binding the arm to the chest wall with triangular bandages or with a Velpeau bandage (fig. 87). Another method of immobilizing the clavicle is by a figure-of-eight support improvised from two belts (fig. 88).

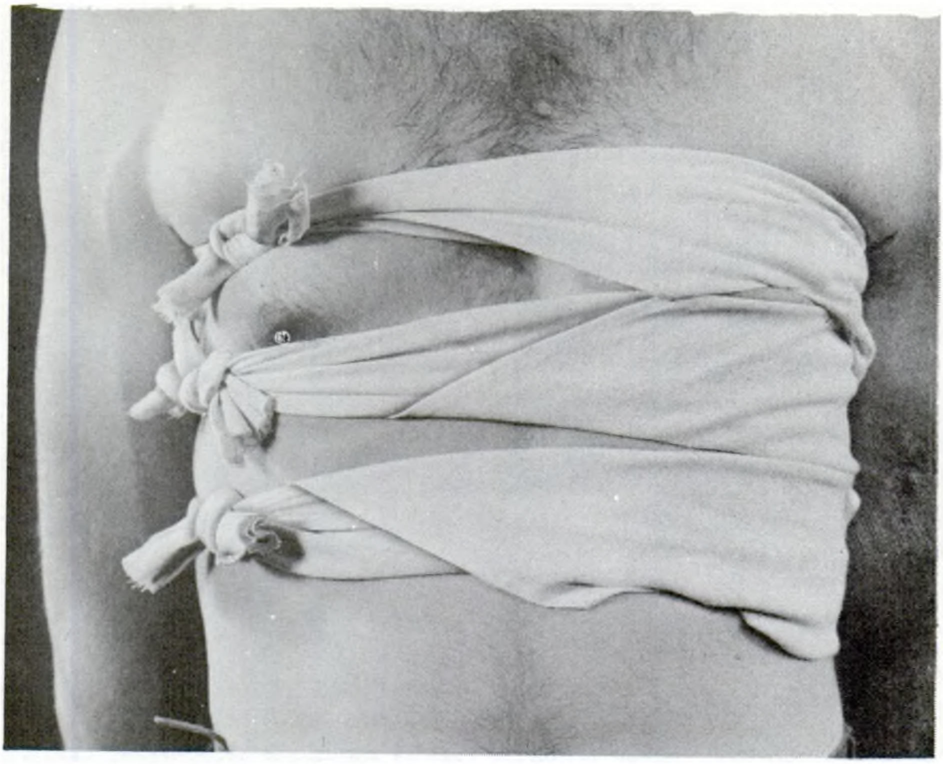


Figure 85. Immobilization of ribs with cravats.

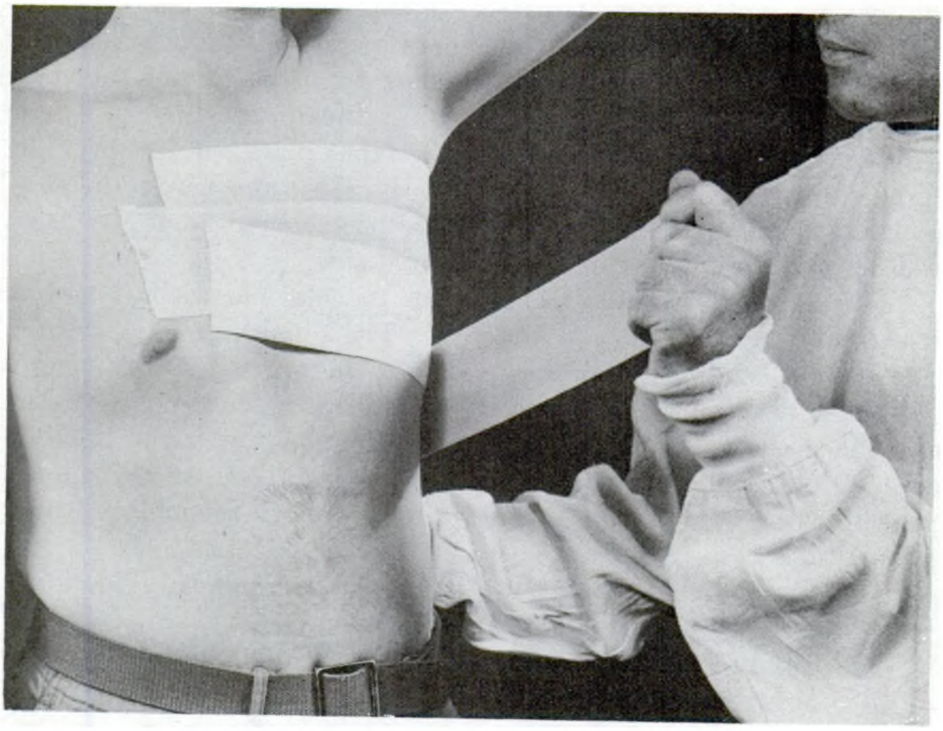


Figure 86. Taping a fractured rib.

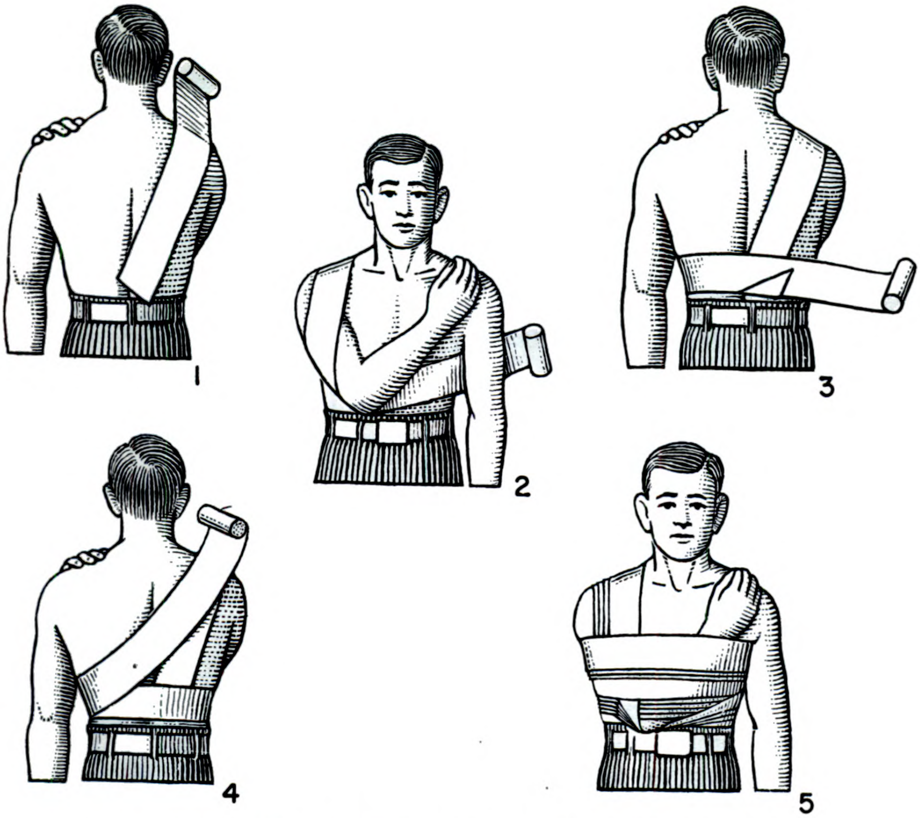


Figure 87. Application of a Velpeau bandage.

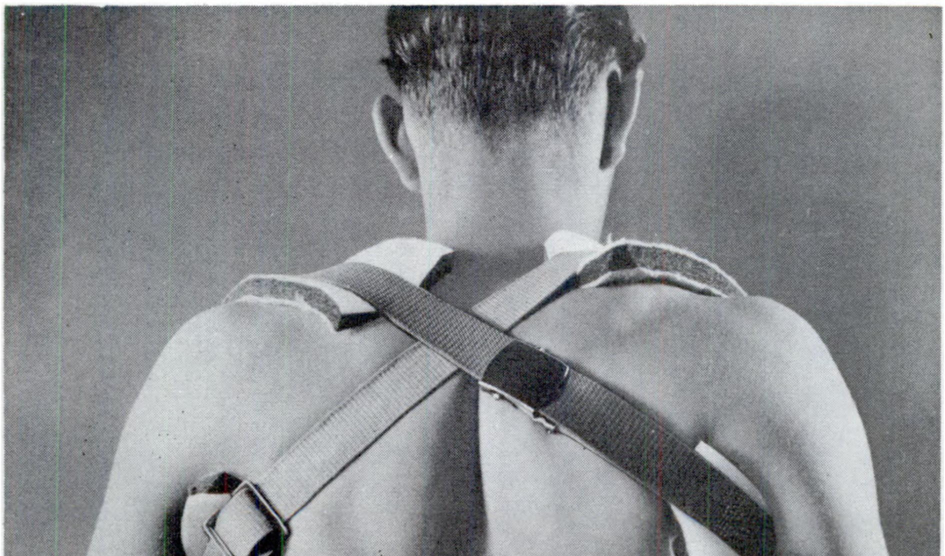


Figure 88. Method of immobilizing clavicle by using two belts in figure-of-eight fashion. Pads should be placed over clavicles and under armpits beneath belts.

184. Dislocation

A dislocation is the displacement of the normal relationship of the articular surfaces of the bones that make up a joint (fig. 89). Dislocation may be caused by a blow or by abnormal twisting or stretching of a joint. Dislocation may occur in any joint. The condition may be partial or complete, acute or chronic. A sprain or a fracture may also be present. In many cases a fracture can be ruled out only by X-ray. In addition, blood vessels, nerves, soft tissues, or other structures surrounding the joint may be injured.

a. Symptoms.

(1) Pain at the joint.
(2) Deformity of the joint.
(3) Usually a complete loss of movement.
(4) Swelling and discoloration about the joint (in some cases).
(5) Shock (in severe cases).

b. Treatment.

(1) Keep the patient as comfortable as possible with the injured part elevated and supported.
(2) Apply cold compresses to the area of deformity. As dislocations generally are held rigid by the patient, support during the bandaging will not always be necessary.
(3) A medical officer will reduce the dislocation.

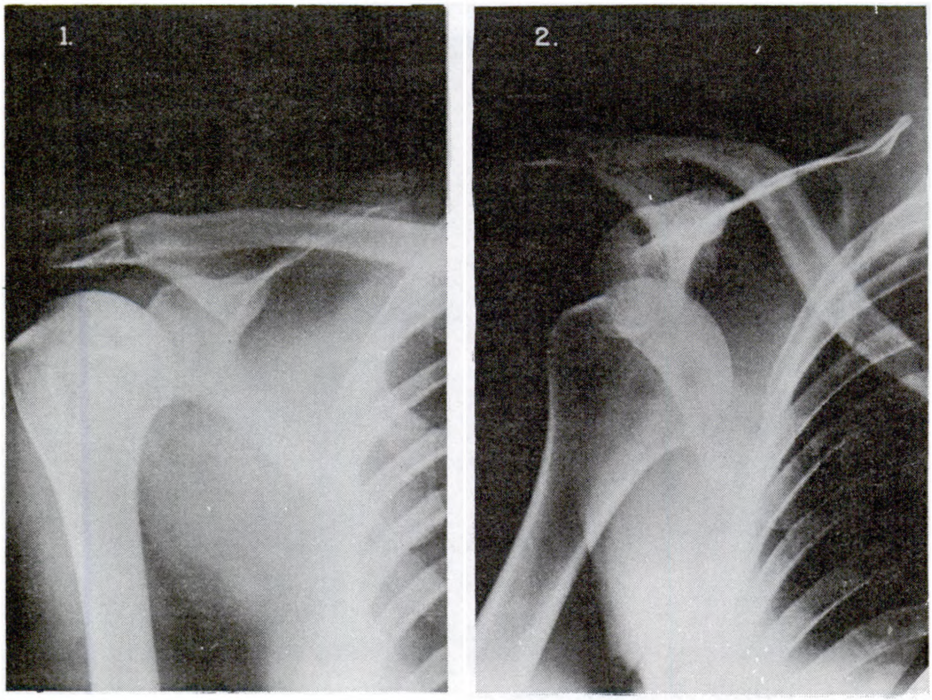


Figure 89. X-rays of (1) Normal joint and (2) Dislocated joint.

(4) Treat for shock if the severity of the dislocation calls for it.

c. Joints Commonly Dislocated.

(1) *Jaw.* Dislocation of the jaw may result from yawning or opening the mouth too wide. When this occurs the patient cannot close his mouth.

(2) *Shoulder.* This may result from a fall or a sudden twist of the arm. One such dislocation predisposes to another. The rounded contour of the shoulder disappears and a sharp bony point is conspicuous, making a square, hard angle. After the dislocation is reduced by a medical officer, the arm is put in a Velpeau bandage (fig. 87).

(3) *Hip.* This injury may be due to a fall or to sudden twisting of the leg. The leg on the affected side is shorter and the foot is turned either inward or outward, according to the type of dislocation. There may be an associated fracture. Shock is frequently present.

(4) *Elbow.*

(5) *Knee.*

(6) *Wrist.*

(7) *Fingers and toes.*

(8) *Spine.*

185. Sprain

A sprain is an injury produced by stretching and tearing of ligaments around a joint. Sprains vary in severity from slight injuries to those causing much damage to tissues around the joint. A sprain is caused by a sudden twisting or stretching of a joint beyond its normal range of motion. Dislocations of the joint as well as fractures of bone may complicate a sprain.

a. Symptoms. At the time of injury, the patient may feel sharp pain and a sudden sensation that the joint has given way. The symptoms are severe pain, rapid swelling, and impairment of function in the joint.

b. Treatment.

(1) Keep the joint at rest and elevate the part (when possible).

(2) Cold compresses will lessen swelling if applied within 6 hours after injury. After 6 hours have passed, hot applications are helpful.

(3) Bandaging or adhesive plaster strapping help immobilize the joint and enable the torn ligaments to heal.

c. Common Sprains.

(1) *Sprained ankle.* This injury is caused by accidental twisting of the foot. Usually, the sprain results from the foot being turned inward. If history of the accident describes "foot turned out," the presence of a fracture is probable. If the foot is "turned in," sprain is more probable. The char-

acteristic symptoms are: sudden, severe pain accompanied by swelling and discoloration. Discomfort in the ankle usually keeps the person from placing weight on the foot. An important diagnostic sign is noted when tension is placed upon the injured ligament and severe pain results. When the ligament is relaxed, the pain disappears. Thus, turning in a sprained ankle to tense the ligament causes pain; turning it out stops the pain. The torn ligament is tender to touch. When a medical officer has made the diagnosis of a sprained ankle, he may order the ankle taped. One method of taping the ankle is shown in figure 90.

(2) *Sprained wrist.* Frequently, the wrist is sprained in a fall or by twisting the hand or wrist. It should be treated by applying a splint to the hand and forearm and by suspending the arm in a sling made from a triangular bandage.

186. Strain

A strain is the result of too sudden and forceful stretching of muscles or tendons, so that a slight tearing takes place. Ordinarily the disability caused by a strain is temporary, and the degree of disability will depend upon the muscles involved and the severity of the injury. Severe strains occur in the larger muscles of the back, shoulders, arms, and legs, and cause the patient much discomfort and

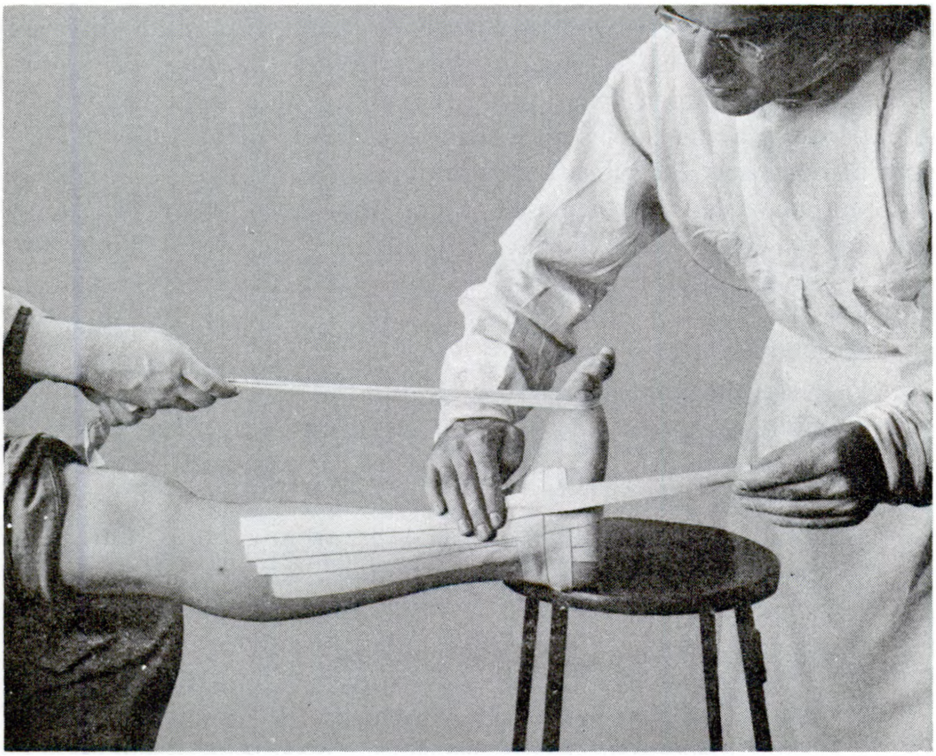


Figure 90. Method for taping a sprained ankle.

inconvenience before recovery is complete. Strains are due to sudden movements of the body; to overexertion while lifting or transporting very heavy weights; to improper placement and balancing of the load; to undue twisting of the limbs or stumbling (which produces strains of the extremities). The most common strain is that of the back caused by an attempt to lift a weight too heavy for the body muscles or by putting weight improperly upon the muscles of the back rather than upon the muscles of the legs and arms.

a. Symptoms. The symptoms of strain are pain in the region of the injury characterized by sharp pain and cramps immediately upon injury; and persistent, sharp pain and marked disability when attempts are made to use the strained muscles. In severe strains a moderate amount of swelling with stiffness and contusion may be found. The muscle fibers are torn apart and blood from the ruptured capillaries infiltrates the tissues. Such symptoms as pain, swelling, heat, redness, and loss of function are well manifested. Complete rupture of a muscle may occur in rare cases.

b. Treatment.

(1) Place the patient in a comfortable position to lessen tension and reduce pressure upon the injured muscles. Elevate the part if possible and keep it at rest.

(2) Heat from a hot-water bottle or a heat lamp will give relief.

(3) Strapping the areas with strips of adhesive tape immobilizes the part and promotes healing.

Section IX. SPECIAL WOUNDS

187. Definition

Special wounds are wounds that require more than ordinary evaluation and treatment. These are wounds of the head, face, neck, chest, abdomen, and urogenital tract.

188. Classification of Head Wounds

Wounds of the head may result from penetrating or perforating wounds, lacerations, contusions, or concussions. They can involve the scalp, skull, brain, or combinations of these structures. Head wounds are classified as *extracranial*, *cranial*, and *intracranial*.

a. Extracranial. These are wounds of the scalp. Common types of scalp wounds are lacerations and contusions. Laceration of the scalp causes a gaping wound and profuse bleeding. Contusion may break blood vessels beneath the skin, causing a hematoma under the scalp.

b. Cranial. These wounds are fractures of the skull. Any part of the skull may be broken by a head injury.

(1) *Basal.* These are fractures of the base or floor of the skull.

(2) *Depressed.* These are fractures in which some part of the skull is "caved in," pressing bone fragments against the brain.

(3) *Penetrating.* These are fractures which carry bone and other foreign material into the brain.

c. Intracranial. These are wounds caused by injuries to meninges, brain, or blood vessels of the brain. Intracranial wounds may occur in any head injury and without either a fracture or an open wound in the skull. They may result in concussion, contusion or laceration of the brain, or increased intracranial pressure. Concussion is due to a blow or fall on the head. Usually, there is temporary and possible intermittent loss of consciousness. There is damage to minute blood vessels of the brain sometimes without fracture or external evidence of serious injury. Severe injury to the brain results in swelling and often hemorrhage from the larger blood vessels. Either swelling or hemorrhage causes increased pressure in the cranium, in and around the brain. Increased intracranial pressure may cause irreversible brain damage. This condition is frequently fatal. Immediate hospital care is necessary.

189. Signs and Symptoms of Head Injuries

a. Wound of the scalp. Any scalp wound may be a wound of the skull.

b. Leakage of blood or cerebrospinal fluid from the ears or nose.

c. Unequal or dilated pupils of the eyes.

d. Paralysis of the arms or legs.

e. Unconsciousness.

f. Depression in or other deformity of the skull.

g. The most dangerous head injury, aside from open brain damage, is one with progressive increase in intracranial pressure. Signs of this condition are unconsciousness, high blood pressure, slow pulse rate, slow rate of respiration.

190. Emergency Treatment of Head Wounds

a. If there is a wound of the scalp or other external head wound, treat as instructed in paragraphs 148 to 152 inclusive.

b. To control bleeding from the ears, cover them with a sterile dressing. Do not try to plug up the ears.

c. Do not remove foreign bodies sticking out from a head wound.

d. Do not give the patient anything by mouth unless he is fully conscious.

e. If there are symptoms of shock, treat as in paragraph 159, but do not give morphine and do not place the patient in shock position. If fluid replacement is required, give fluids slowly.

f. If the patient also has wounds of jaw or face, or if he is vomiting, position him to prevent aspiration of fluids.

g. Examine the patient for paralysis, consciousness, and difference in the size of the pupils of the eyes. Record these signs on the patient's emergency medical tag. Also record circumstances of injury.

h. Evacuate promptly on a litter. If the patient is unconscious, transport him on his side or abdomen and maintain airway. Patients with increased intracranial pressure have first priority in evacuation.

191. Emergency Treatment of Maxillofacial (Jaw and Face) Wounds

a. Control hemorrhage by pressure dressing or digital pressure. Arterial hemorrhage may be stopped temporarily by finger pressure applied to the points indicated in figure 91. The pulsation of the artery should be located and pressure applied firmly enough to stop the bleeding. As soon as possible, hemostatic forceps or a clamp should be used to clamp the bleeding vessel, which is then tied with a suture.

b. Provide adequate airway. The mouth should be cleared of fragments of bone, teeth, fillings, dentures, particles of clothing, soft tissue, or blood. Put dentures in the patient's pocket for later use. Prevent the tongue from falling back in the throat and cutting off passage of air. This may be done by passing a safety pin through the tip of the tongue and attaching it by a rubber band to a shirt button (fig. 92). Position the patient so he can breathe. If the patient cannot breathe and the obstruction of his airway cannot be relieved by any other means, an emergency tracheotomy should be performed (par. 192).

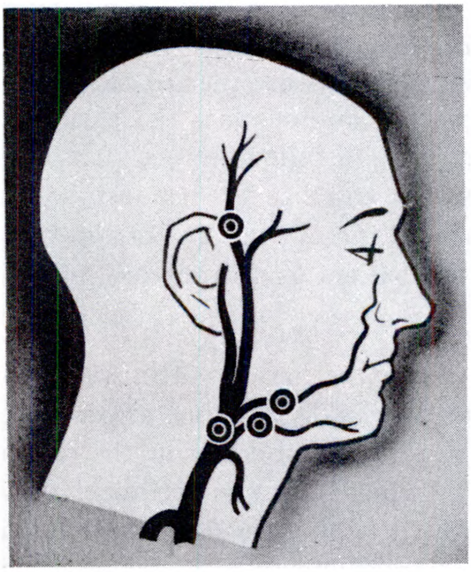


Figure 91. Pressure points for control of hemorrhage of the face.

Figure 92. Emergency traction of tongue.

c. Immobilize the parts. Support the jaw by a cravat bandage (fig. 93) or by a first aid dressing, but do not bandage the mouth shut. A wad of gauze placed between the teeth in the back of the jaw will keep the jaws apart enough to maintain an airway and to permit free drainage from the mouth. A traction device may be improvised if the jaw fragments are pushed backwards (fig. 94).

d. Treat for shock but do not place the patient in shock position. Morphine may be given to relieve severe pain only if the casualty is completely conscious and has no respiratory distress.

e. If wounds involve the eye, cover both eyes with sterile dressings and evacuate the patient as a litter case, preferably on his back.

192. Tracheotomy

Tracheotomy is the operation of cutting into the trachea. It is done to provide an airway by making an opening in the trachea. In some cases of respiratory obstruction the tracheotomy is a lifesaving procedure. Under such circumstances it becomes an emergency procedure and it should be performed immediately.

a. The emergency tracheotomy is indicated when a casualty has an obstruction of the upper airway that cannot be relieved by any

Figure 93. Method of bandaging jaw wounds.

other means. Conditions that may result in respiratory obstruction requiring tracheotomy are—

(1) Maxillofacial wounds and injuries.
(2) Neck wounds and injuries involving the trachea or the larynx.
(3) Excessive swelling (edema) following wounds and injuries of the neck and the floor of the mouth.
(4) Neck wounds with bleeding into tissue spaces.
(5) Burns of the face and neck.
(6) Aspiration of a foreign body.

Figure 94. Traction device for broken jaw.

b. The emergency tracheotomy may be indicated in open chest wounds and in head wounds with respiratory difficulties.

193. Emergency Treatment of Wounds of the Eye

The following principles apply to emergency medical care of wounds or injuries of the eye.

a. Treat life-endangering wounds first and limit eye care to the bare essentials. Only a medical officer can provide definitive treatment.

b. Protect the eye from contamination by putting a sterile dressing over it.

c. Evacuate all but the most minor eye casualties.

d. Casualties with obvious or suspected penetrating wounds of the eye and casualties with retinal detachment require bilateral sterile dressings and must be evacuated as litter cases with head immobilized.

e. Chemical agents in the eyes should be flushed out at once with water.

f. Record on the emergency medical tag all circumstances of wounding or injury and all emergency care measures given the casualty.

194. Emergency Treatment of Wounds of the Neck

a. Control hemorrhage with a pressure dressing or by digital (finger) pressure. Apply pressure upward, not backward.

b. Prevent suffocation. Do not apply a constricting circular bandage around the neck. Clear the breathing passages. Place the

patient in a position that will allow proper drainage. Give nothing by mouth.

c. Suspect a fracture of the neck and handle the patient as instructed in paragraph 183*g*.

d. Treat for shock but do not place patient in shock position.

195. Open or Sucking Chest Wounds

A sucking chest wound, or open pneumothorax, is one with an opening extending from the outside through the chest wall into the chest cavity. The opening admits air from the outside into the pleural space (between lung and chest wall). This causes the lung to collapse on the injured side (fig. 95). It also impairs the functioning of the opposite lung.

a. Signs and Symptoms.

(1) Opening in chest wall. The wound may be either perforating or penetrating. Always look for a wound of exit.

(2) Frothy blood splutters from the wound (hemorrhage from the lungs).

(3) Hemoptysis. Blood is coughed up.

(4) A sucking noise will be heard as the casualty inspires. The noise is due to air being pulled through the abnormal opening in the chest wall.

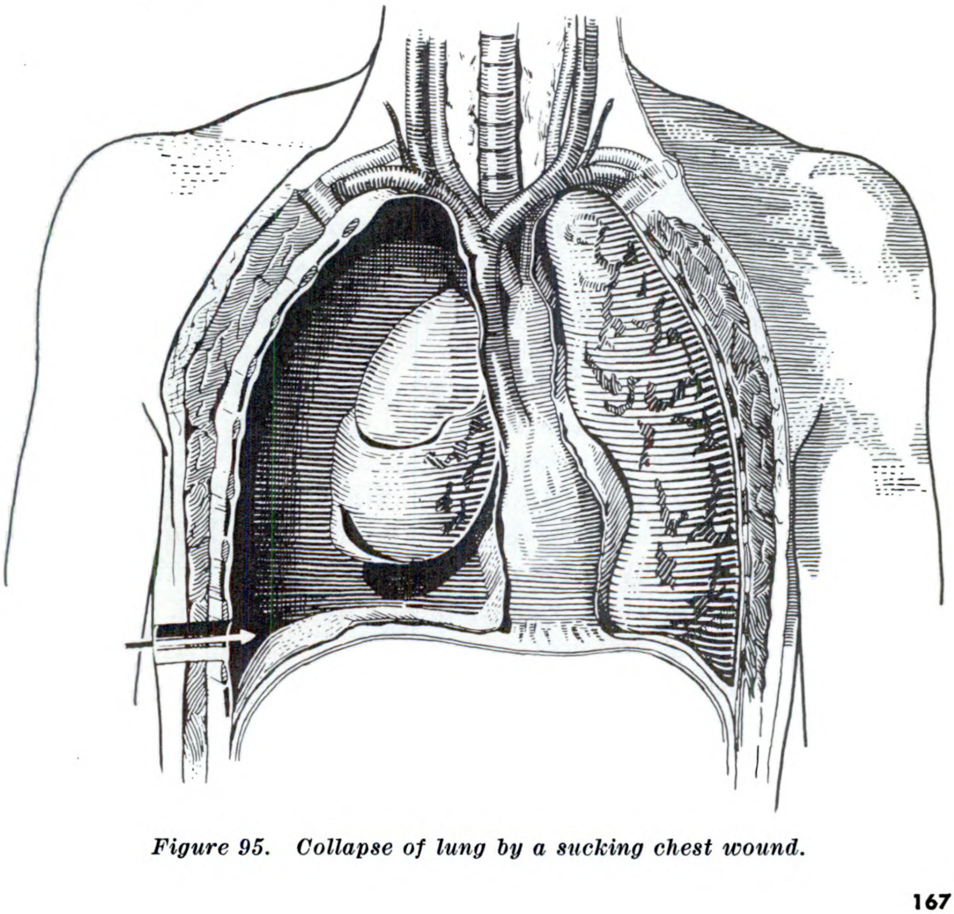


Figure 95. Collapse of lung by a sucking chest wound.

(5) Patient is short of breath and is panic-stricken.
(6) The skin is blue (cyanosis).
(7) Shock may be present.
(8) Patient is unable to lie on his back because of difficulty in breathing.

b. Treatment.

(1) Make the wound airtight by covering it with a pressure dressing. Strap the dressing with adhesive tape to make it completely airtight.

***Caution:* Be sure the strapping does not hinder respiration on the uninjured side.**

Vaseline gauze may be used to help make the dressing airtight.

(2) Provide an adequate airway. Put patient in position for easiest breathing, either sitting, leaning backwards, or lying on injured side. Clear breathing passages of blood and mucus to help prevent aspiration of fluids.
(3) Look for evidence of abdominal injury before giving drugs orally. If there is no wound of exit, or if a wound is below the nipple level, do not give anything by mouth because of the possibility of an associated abdominal injury.
(4) Treat for shock but do not put patient in shock position. Do not give morphine. Fluid replacement should be limited.
(5) Transport the patient with chest and head elevated and lying on injured side.
(6) Oxygen should be given if patient is cyanotic. The patient should be evacuated to a hospital as soon as possible.

196. Chest Injuries Caused by Compression (No External Wound Present)

a. Blast Injury. This injury suddenly compresses and injures the lungs. It may be a serious condition. The signs and symptoms are hemoptysis (coughing up blood), shock, difficult breathing, blueness of face and neck, and mild hemorrhage of eyeballs. Treatment consists of rest in bed and oxygen.

b. Traumatic Asphyxia. In this condition, blood is forced out of the heart back into valveless veins of the neck and head. It is not serious. It is caused by less severe blast compression which does not injure lungs, but squeezes venous blood up into head. The signs and symptoms are as follows: veins of neck and head are distended, bluish or purplish discolorations of head and neck, and hemorrhages in skin and eyes (bloodshot). The treatment is the same as for blast injury.

c. Caved-in Chest. The cause of a caved-in chest is a crushing injury to the ribs and possibly sternum (no external wound is neces-

sarily present). It usually involves two or more ribs broken in two or more places. The signs and symptoms are deformity and abnormal mobility of chest wall, tenderness and pain, dyspnea, shock, irregular respiration, cyanosis, and hemoptysis. Emergency treatment consists of rest, immobilization of injured area with muslin or adhesive, and oxygen if available.

197. Abdominal Wounds

a. Description. Abdominal wounds may be caused by bullets, bomb or shell fragments, bayonets or knives, and by a variety of other objects. The most serious abdominal wounds are those which penetrate the abdominal wall and perforate internal organs or large blood vessels. These wounds require rapid emergency treatment and early evacuation for definitive treatment. Surgery to repair internal damage is imperative in most abdominal wounds. One of the main factors that determine the outcome is the time which elapses before the surgical operation. The mortality increases as the time between wounding and surgery lengthens.

b. Signs and Symptoms.

(1) Any penetrating wound of the abdominal wall.

(2) Shock.

(3) Rigidity of abdominal muscles.

(4) Generalized abdominal tenderness.

c. Complications in Abdominal Wounds. The chief complications are—

(1) Hemorrhage, which is difficult to control except by operation.

(2) Shock, which is severe and difficult to control especially if hemorrhage is present. The liver when wounded bleeds freely and produces severe shock.

(3) Peritonitis, which occurs later and is, aside from hemorrhage, the main cause of death in patients with abdominal wounds. Infection of the peritoneum can occur from bacterial contamination introduced by a bullet, shell fragment, or bayonet from outside the body. Even if the wounding agent is sterile it can carry contaminated clothing or other foreign material into the wound. Another source of infection is the infective material which escapes from the stomach, large intestine, and other abdominal organs when they are perforated. Lacerations of the bladder or urinary passages may allow the escape of urine, which is irritating and causes inflammation. Lacerations may also cause secondary infection of those organs.

d. Emergency Treatment.

(1) Cover all abdominal wounds completely with sterile dry dressings to prevent contamination from the outside. A

universal protective dressing may be used for large wounds.

(2) Do not touch or try to push in organs that are protruding or exposed. Cover these with sterile first aid dressings.

(3) The lips may be moistened but nothing is given by mouth. This rule is laid down for two reasons. First, anything given by mouth may leak into the peritoneal cavity through wounds of the hollow organs and so spread infection. Second, since these patients will require an anesthetic for surgical operation within a short time, it is best to keep the stomach empty.

(4) Treat for shock. Give blood or plasma volume expanders. Use shock position.

(5) If morphine is indicated (severe pain), it should be given intravenously and in small amounts as directed by a medical officer. Route of administration, time, and dose should be recorded on the patient's emergency medical tag.

(6) Give antibiotics (penicillin and streptomycin) to reduce infection.

(7) Evacuate to a hospital as soon as possible. Transport patient on his side with knees flexed to reduce tension on the abdomen.

Section X. BURNS

198. Classification of Burns by Cause

a. Thermal Agents. Thermal burns are those caused by heat. Thermal injury can result from flames, steam, hot metals, hot water or hot liquids, gasoline explosions, nuclear explosions, and such incendiaries as white phosphorus, magnesium, thermite, and napalm.

b. Electricity. Electrical burns are those caused by lightning or by contact with an electric wire. These burns are seen where the electric current enters and leaves the body.

c. Chemical Agents. The contact of strong acids, alkalies, propellant fuels, or oxidizers to the skin cause burns similar to thermal burns.

d. Radioactive Agents. Radiation from radioactive materials, X-ray machines, or nuclear explosions can cause burns. In a nuclear explosion, however, most burns will be caused by heat.

199. Classification of Burns by Degree of Damage

Burns are classified in degree according to the depth to which the tissues are injured.

a. First Degree. Skin is reddened and unbroken, as in simple sunburn.

b. Second Degree. Top layer of skin is blistered and partly destroyed. Severe sunburn and burning by hot liquids (scalding) are examples.

c. Third Degree. Entire skin thickness is destroyed or charred, as from burning by flames, with the injury extending to tissues beneath the skin.

200. Classification of Burns by Extent (Rule of Nine's)

The overall severity of a burn generally depends more on the extent of body surface burned than on the depth of the burn. The extent of a burn is estimated by the *rule of nine's* illustrated in figure 96. This rule divides the body into areas representing 9 percent of the body surface or multiples of 9, as follows: the head and neck, 9 percent; the chest, 9 percent; the abdomen, 9 percent; each arm, 9 percent; entire surface of the back, 18 percent; each leg, 18 percent. The genitalia are counted as 1 percent of the body surface. In any patient with burns of more than 20 percent of the body surface, shock can be expected; therefore, treatment to prevent shock should be started as soon as possible. If deep burns cover more than 50 to 60 percent of the body surface, death very often follows.

201. Classification of Burns by Severity

Burns are classified by severity as minor, moderate, and critical. This classification depends upon the degree of burn, percent of body area burned, and location of burns on the body. This method of classifying burns is intended for sorting of masses of casualties caused by nuclear warfare (TB Med 246).

a. Minor Burns. These are second degree burns of less than 15 percent of body area or third degree burns of less than 2 percent of body area.

b. Moderate Burns. These are second degree burns of 15 to 30 percent of body area or third degree burns of less than 10 percent of body area, except the face, hands, and feet.

c. Critical Burns. These are second degree burns of more than 30 percent of the body; or third degree burns of more than 10 percent of the body, or of the face, hands, and feet; or burns complicated by injury of the respiratory tract, fractures, major soft tissue injury, or electrical burns.

202. Complications of Severe Burns

a. Shock. This is responsible for 60 percent of all deaths from burns. Emergency treatment in all but the most minor burns must be directed primarily at the prevention and treatment of shock. Shock occurs within 24 to 36 hours in 2d or 3d degree burns that involve more than 20 percent of the body surface.

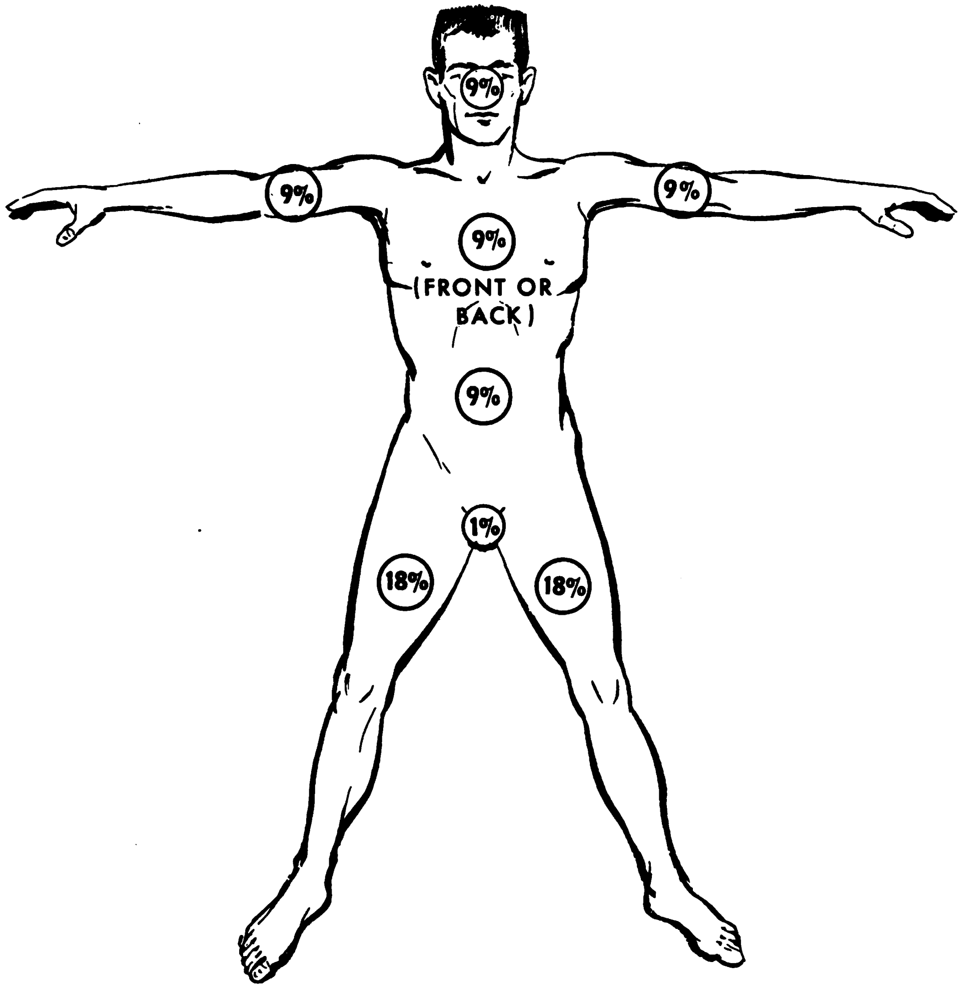


Figure 96. Method of estimating percent of body area burned.

b. Infection. This accounts for most of the other deaths from burns. Although most burns are normally free of infection when they occur, the danger of infection is great and preventive treatment should be started promptly. Infection in many cases is due to contamination from the nose and throat of attendants.

c. Anemia. This results from destruction of red blood cells. Anemia should be treated as early as possible by transfusion of whole blood.

d. Toxemia. Absorption of toxins formed at the site of the burn contributes to further destruction of red blood cells and is accompanied by fatigue and weakness.

e. Oliguria and Anuria. (No urine is execreted).

f. Curling's Ulcer. This is ulcer of the stomach and duodenum which may follow severe stress, especially severe body burns.

g. Scarring and Contractures. These late complications can be minimized by proper treatment.

h. Tetanus. Tetanus is caused by the specific toxin of the micro-organism *Clostridium tetani*, and is characterized by toxic spasms of several or all the striated muscles. Muscles of the lower jaw are usually the first affected; for this reason, the disease is often called *lockjaw*.

203. Emergency Treatment of Burns

a. Objectives. The objectives of emergency treatment are the same in all burns. They are: prevention and treatment of shock, prevention of infection, and relief of pain.

b. First Degree Burns. Use of a dry, sterile dressing over the burned area is optional. Do not apply ointment, cold cream, or any other medication.

c. Second and Third Degree Burns.

(1) Shock should be treated at once. The important measures are discussed here and in paragraph 159. Burn shock results from the rapid loss of body fluids in amounts great enough to deplete the circulating fluids in the vascular system. Lost fluids should be replaced as soon as possible. Fluid requirements are based on the percent of body area burned as determined by the rule of nine's (par. 200) and on the severity of the burn. Patients with burns of 10 to 40 percent or 20 to 40 percent of body area should be treated by intravenous injection of whole blood, dextran, or glucose and saline solutions. An approximate scale of plasma expander requirements is given in table IV. When whole blood is not available, give dextran. Patients with burns of less than 10 or 20 percent of body area should be given fluids by mouth unless fluids are contraindicated (par. 159). The oral replacement solution consists of ½ teaspoonful table salt (or four issue salt tablets) and ½ teaspoonful baking soda (or two issue sodium bicarbonate tablets) in one quart (one canteenful) of cold water. If available, use one packet of the standard package of sodium chloride-sodium bicarbonate mixture, 4.5 gm., in water instead of the solution above.

(2) Remove clothing from around burned areas. Cut it away if necessary. Do not try to remove pieces of clothing that are stuck in the burned tissues.

(3) Do not apply soda, ointment, paste, or any other medication to the burned areas.

(4) Cover the entire burned area with a dry sterile dressing, such as a *universal protective dressing* or a first aid dressing. Hold it firmly in place with a gauze or a muslin bandage. The universal protective, or burn, dressing is designed specially for use on burns. It is extra-large, made in two

sizes for burns involving large areas of the body such as the back and the chest.

(5) Avoid contaminating the burned surface by your hands or your breath. Cover your nose and mouth with a mask or a handkerchief. Keep your mouth closed while examining the burn and putting a dressing on it. If the patient can be taken *promptly* to a hospital or a dressing station, it is enough to cover the burn with sterile dressing or triangular bandages and confine immediate efforts to treatment of shock.

(6) Relieve pain. Burns are among the most painful types of injuries. If the patient is *not* in shock, an initial dose of ¼ grain of morphine intramuscularly is recommended. If the patient is in shock, morphine should be given intravenously (by a medical officer) in a recommended initial dose of ⅛ grain. Morphine may be given safely in most cases where the respirations are 12 and above.

(7) Antibiotic treatment should be started promptly and continued until danger of infection is past.

(8) Tetanus toxoid, ½ cc., should be given to all patients with second or third degree burns.

d. Chemical Burns. The chemical agent should be removed from the skin or neutralized as rapidly as possible. Dilute the chemical first by drenching it repeatedly with water, then apply a weak neutralizing agent. See TM 8–285 for treatment of burns caused by vesicants (blister gases) and such incendiary agents as thermite, magnesium, and white phosphorus.

e. Oxidizer and Propellant Fuel Burns. See FM 21–11 for first aid measures for these burns. See TB Med 242 for a full discussion of burns and other health hazards from oxidizers and propellant fuels.

Section XI. NERVE GAS POISONING

204. Signs and Symptoms of Nerve Gas Poisoning

a. Liquid nerve gases quickly build up dangerous vapor concentrations, and personnel must mask at once upon detection or suspicion of either liquid or vapor. Constriction of the pupils of the eyes of persons near you is a signal to mask. Masking at once is imperative if an unexplainable faint, sweet odor is detected, or if dimmed vision, headache, nausea, chest tightness and breathing difficulty, muscular twitching, or convulsions occur.

b. The various nerve gases differ in volatility, persistency, and in speed of effect, but the nature of their action is the same. Minimal vapor exposure causes constriction of the pupils of the eyes and dimmed vision for 1 to 3 days. Successively heavier exposure quickly

causes the following additional symptoms: chest tightness, breathing difficulty, excessive flow of saliva, headache, muscular incoordination and twitching, nausea, mental confusion, lowered blood pressure, slow pulse, bronchial spasm, cyanosis, convulsions, and failure of respiration. Death may result if immediate treatment is not given.

c. After absorption of the liquid agent by eyes, mouth, or nose, symptoms will follow within 1 to 2 minutes. Body skin absorbs the liquid more slowly, but symptoms will appear in 5 to 20 minutes. The course of physiological effect of the liquid agent is similar to that of vapor inhalation except that the first symptom may be muscular twitching at the point of the liquid absorption. Nerve gas vapors ordinarily do not harm masked personnel.

205. Treatment of Nerve Gas Poisoning

a. Using the atropine syrette (par. 206), inject 2 mgs. of atropine intramuscularly at once. Repeat injections as necessary to relieve the symptoms but do *not* give the patient a greater total dose than 6 mgs. (three syrettes) of atropine without the advice of a medical officer. In moderately severe cases with bronchial spasm, labored breathing, cyanosis, slow pulse, and lowered blood pressure, the medical officer may give 2 mgs. of atropine every few minutes until these symptoms are relieved and the casualty complains of a dry mouth.

b. If the casualty is having breathing difficulty, administer artificial respiration (par. 217). Artificial respiration is the first treatment; do not interrupt it to give atropine. Artificial respiration may be needed for an hour or more before natural breathing is restored.

c. Do not allow the casualty to smoke. Smoking aggravates respiratory and gastrointestinal symptoms.

206. Atropine Syrette

a. Description. The atropine syrette consists of a small, collapsible tube containing 1 cc. of atropine tartrate solution (equal to 2 mgs. of atropine sulfate) with an injection needle attached. The needle is covered by a transparent plastic cover and has a thin wire stylet that extends down through and out beyond the tip of the needle. The syrette is packaged in a round, plastic container with a screw-on cap. Directions for use are printed on the container.

b. Technique for Injection. See FM 21–11.

Section XII. UNCONSCIOUSNESS

207. Unconsciousness

Unconsciousness means that the patient is completely unaware of what is going on around him and is unable to make purposeful movements. Sleep is the only normal unconsciousness; fainting is brief unconsciousness; coma is prolonged unconsciousness. The most com-

mon causes of unconsciousness are: the cerebral vascular accident (stroke), head injury, heat stroke, poisoning, emotional stress, alcoholism, anoxia, and epilepsy. The cause of unconsciousness is frequently not apparent. The following general measures must be taken until specific treatment can be started:

a. Send for a medical officer immediately in all cases of unconsciousness.

b. Examine the patient. Be certain the patient has an unobstructed airway. Look for head injury, signs of bleeding (par. 150), heat stroke (par. 223) and poisoning (par. 218).

c. Do not unnecessarily move the patient. Generally it is best to let him lie in place.

d. Never give an unconscious person anything by mouth.

e. Never give morphine to an unconscious person.

208. Fainting

Fainting is temporary unconsciousness due to reduced blood supply to the brain. It may be caused by emotional shock, exhaustion, heat, malnutrition, bleeding, or lack of fresh air. With fainting there is sudden unconsciousness, pallor, cool moist skin, weak pulse, shallow breathing, and dilated pupils. The treatment is to lay the patient down with his head lower than the rest of his body. Loosen clothing. In a crowded area get the patient into fresh air. Massage the arms and legs toward the body. Examine patient to be sure no other injury is present.

209. Epilepsy

Epilepsy is a disorder of the nervous system characterized by a sudden attack of at least momentary unconsciousness and frequently by involuntary, abnormal muscular movements. In the mildest form there is only a momentary lapse of consciousness and the patient does not fall. In the severe form the patient often utters a cry and falls with the body held rigid. This is followed by general convulsions with rhythmic jerking of the limbs and other body and facial muscles. Frequently the tongue is bitten and sometimes there is involuntary evacuation of the bladder and bowels. For lack of breathing the patient may become cyanotic. After convulsions the patient usually passes into a deep sleep. Most seizures last only a few minutes. No immediate treatment is necessary. Except to keep the patient from falling off the bed, etc., there is no need to hold him. However, a pad or twisted handkerchief placed between his teeth will keep him from biting his tongue. Sometimes people who are emotionally upset will hold their breath and thrash around on the floor; other people will feign epileptic seizures and these are sometimes very difficult to distinguish from a true seizure. In general,

the feigning patient does not hurt himself in the fall, does not bite his tongue nor lose control of bowels and bladder.

210. Emotional Unconsciousness

Unconsciousness due to emotional upset has been covered in paragraphs 207 and 209.

211. Unconsciousness Caused by Acute Alcoholism

The condition of unconsciousness caused by acute alcoholism is easy to confuse with similar conditions. Even if an unconscious person has the odor of alcohol on his breath; he should be examined carefully to find out the true cause of unconsciousness. Mistakes in diagnosis are frequent. Cases of fractured skull or apoplexy often are diagnosed as alcoholism. The patient may have been drinking and had an apoplectic stroke, or, drunk and falling, may have fractured his skull. If there is the least uncertainty, it is better to give the patient the benefit of the doubt and to treat him for the more serious condition. A person suffering from acute alcoholism may lie in a stupor but usually he can be partly aroused and made to answer questions. The face is flushed, the pulse is full and rapid at first, feeble and slow later. Breathing is deep. The pupils are usually dilated and the breath has the heavy odor of alcohol. If the patient is just "drunk" and is not suffering also from other illnesses or injury, his mouth should be cleared of vomitus and foreign objects which may impair breathing. He should be turned onto his stomach with head to one side and allowed to sleep it off.

Section XIII. ASPHYXIA AND ARTIFICIAL RESPIRATION

212. Asphyxia

a. Description. Asphyxia is a condition in which there is lack of oxygen and an excess of carbon dioxide in the blood and tissues. It is attended by a feeling of suffocation and later by coma. Asphyxiation may result from any impairment of respiration which cuts off the supply of oxygen to body tissues. Oxygen is essential for all living tissue, especially the brain, which requires a continuous supply of oxygen. Tissues of the brain can tolerate lack of oxygen (anoxia) no longer than 2 to 5 minutes before death becomes certain to occur. Usually in asphyxiation the brain is depressed so that the heart continues to beat for a short time although breathing stops. During this short interval *artificial respiration* may save life if it is started *at once.*

b. Causes. Asphyxia is caused by many conditions in which artificial respiration may save life. These are the following:

(1) *Effects of drugs.* Certain drugs cause asphyxia by depressing the respiratory center in the brain. These drugs include morphine, codeine, the barbiturates, and some anesthetics.

(2) *Carbon monoxide.* Carbon monoxide poisons the red blood cells so they can't carry oxygen as well and breathing stops for lack of oxygen to the brain.

(3) *Suffocation.* This results when the lungs are deprived of air because of blockage of air passages or lack of oxygen in the air breathed in. Common causes of suffocation are drowning and strangulation. In drowning water blocks the air passages to the lungs and leads to suffocation. In strangluation external constriction or squeezing of the neck compresses the air passageway in the throat and obstructs the flow of air in and out of the lungs. Suffocation may occur from breathing air too low in oxygen, as is found in unventilated wells and silos or at high altitudes. Suffocation may also result when a person is buried by dirt, debris, or snow.

(4) *Electrical shock.* This condition causes asphyxia by paralysis of the respiratory center in the brain. It may also affect the heart, either stopping the heart or slowing its pumping action.

(5) *Other conditions.* Other conditions which may cause breathing to stop include head injuries or diseases involving the respiratory center in the brain, such as brain concussion or poliomyelitis.

213. Drowning

Being under water more than 5 minutes usually causes death, but an effort always should be made to revive a person who seems to be drowned unless it is known that the body has been under water for a long time.

a. Signs. The person may be in or near water. The body is limp and cold and the face cyanotic. The tongue is swollen and the mouth filled with mucus. Breathing may be absent or the person may be gasping for air. The pulse is weak or cannot be felt at all.

b. Treatment. Begin artificial respiration at once (par. 216).

214. Electrical Shock

Electrical shock is produced by a current of electricity passing through the body. It can be caused by lightning, by contacts with high voltage electric current such as fallen power lines, or by contact with ordinary 110–volt current.

a. Signs. The person is likely to be unconscious, pale, and cyanotic. The pulse is weak and sometimes there are burned areas on the body.

b. Rescue and Treatment. The person must be released from contact with the electric current as soon as possible. If the switch is

nearby turn off the current, but do not waste time looking for a switch. The rescue of a person from a live wire is dangerous. Do not touch the person or the wire with your bare hands. Use a dry pole, dry clothing, dry rope, or some other material that will not conduct electricity, to remove the person from the wire (fig. 97). If a pole is not handy, drag the person off the wire by using a loop of dry cloth, or flip the wire away from the victim. Start artificial respiration as soon as he is freed from the wire. The body may be stiff, but this is not always a sign of death. Continue artificial respiration until normal breathing returns or until a medical officer declares the patient dead. After the person is breathing normally treat him for shock and burns.

215. Carbon Monoxide Poisoning

Carbon monoxide is a colorless, odorless gas produced by incomplete burning of any carbon-containing compound, such as gasoline, kerosene, oil, coal, or wood. It is always given off by the exhausts of automobiles and other gasoline engines. It may be given off by fires burning in badly ventilated tents or bunkers. Carbon monoxide is deadly in its effect on the body. It combines with the hemoglobin of the red blood cells much more readily than does oxygen. Once the

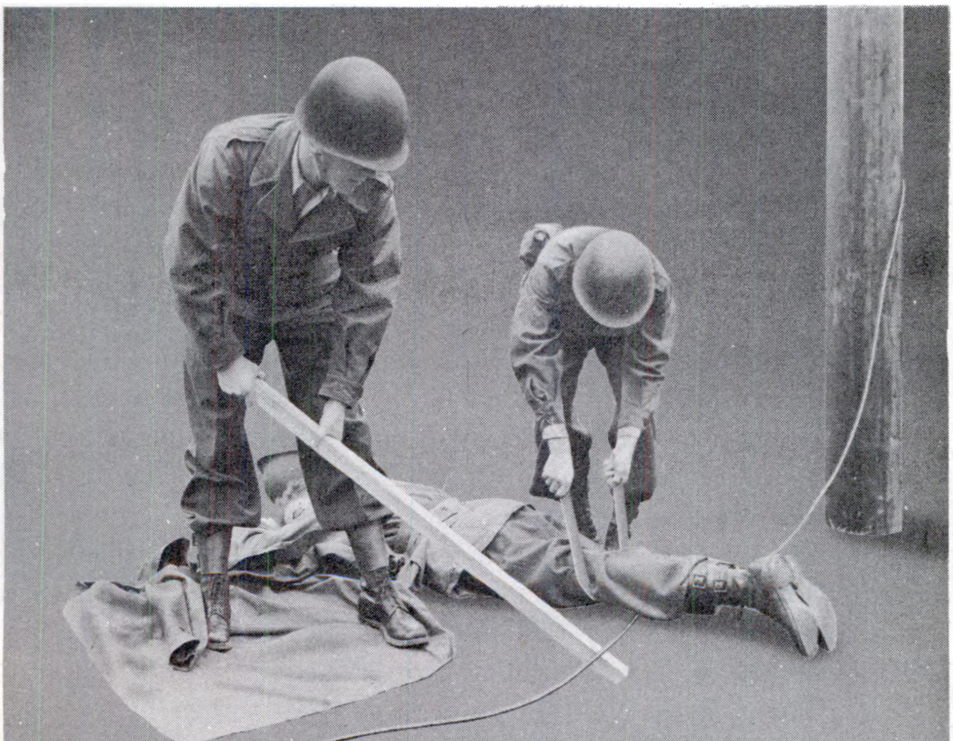


Figure 97. Rescue of a person from an electric wire.

hemoglobin has combined with carbon monoxide, it cannot take up oxygen. The blood then cannot carry oxygen from the lungs to the tissues, and asphyxiation occurs.

a. Symptoms. The early symptoms of carbon monoxide poisoning include headache, yawning, dizziness, muscular weakness, ringing in the ears, cherry-red skin, and perhaps nausea and vomiting.

b. Treatment. Get the person into fresh air as quickly as possible. Apply artificial respiration. Give oxygen if it is available.

216. Artificial Respiration

a. Methods. See paragraph 217.

b. Principles. Always observe the following general principles in performing artificial respiration.

(1) *Time is of prime importance, seconds count.* Begin at once. Do not take time to move the victim to a better place unless the combat situation demands it. Do not delay resuscitation to loosen clothing, to warm the victim, or to apply stimulants. These are secondary to the main purpose of getting air into his lungs.

(2) Quickly place the victim's body in the prone or supine position, slightly inclined in such a way that fluids will best drain from his respiratory passages.

(3) Clear the air passages. Straighten the victim's neck and turn the head sideways so that the tongue falls forward, the respiratory passageway is straight and open. Quickly sweep your fingers into the victim's mouth to remove froth, false teeth, and debris, and to draw his tongue forward.

(4) Begin artificial respiration, continue it at a steady rhythmic rate without interruption until spontaneous breathing starts, or the victim is pronounced dead. A smooth rhythm is desirable, but split-second timing is not essential.

(5) If the victim begins to breathe on his own, adjust your timing to assist him. Do not fight his attempts to breathe, but synchronize your efforts with his. After resuscitation, he should remain lying down until seen by a physician or until recovery seems assured.

(6) As soon as the victim is breathing for himself, or when additional help is available, see that his clothing is loosened (or removed, if wet) and that he is kept warm. Shock also should receive attention. However, do not interrupt rhythmical artificial respiration to do these things.

217. Methods of Artificial Respiration

a. Mouth-to-Mouth Method. In an uncontaminated atmosphere the preferred method of artificial respiration is the mouth-to-mouth

method and its variations. See FM 21–11 for a complete description of this method and its variations.

b. Mouth-to-Airway Method. In this method of artificial respiration the rescuer exhales into a pharyngeal airway inserted into the victim's mouth. The pharyngeal airway is a rubber tube-like device with a mouthpiece. It may be used as follows:

(1) Place the victim in a supine position. Open his mouth with one hand and remove any foreign material from the mouth with the other hand.

(2) Insert the airway in his mouth so that it rests behind the tongue. Be careful not to push the tongue back but to hold it forward.

(3) Tilt his head back so that the neck is stretched and the chin is up. Close his lips and nose with your hands to prevent air leaks.

(4) After a deep breath, exhale immediately into the airway with enough force to expand the patient's chest.

(5) When his chest rises, stop, and remove your mouth from the airway. Take another deep breath while listening for his exhalation.

(6) When exhalation is finished, blow in the next deep breath. Continue breathing at a rate of about 15 breaths a minute until the patient begins to breathe spontaneously.

(7) If the patient's stomach becomes distended with air, apply gentle hand pressure to the stomach between breaths.

Note. This method should not be employed unless the user has been *well-trained* in the insertion of the pharyngeal airway. At times, the insertion of such an airway will be difficult, and prolonged attempts by the inexperienced will result in unnecessary injury to the patient. The airway should not be used if the patient cannot tolerate it without gagging, coughing, or vomiting. Also, it should be remembered that a properly placed pharyngeal airway does not prevent obstruction unless the head and neck are extended.

c. Mouth-to-Nose Method. This method of artificial respiration is for use in an uncontaminated atmosphere when neither the mouth-to-mouth method (*a* above) nor its variations can be used. For example, the mouth-to-nose method could be used on casualties with severe jaw spasm or with wounds of the jaw or mouth. See FM 21–11 for a description of the mouth-to-nose method.

d. Chest-Pressure Arm-Lift (Modified Silvester) Method. Although the mouth-to-mouth method (*a* above) is the method of choice, it cannot be applied in a contaminated atmosphere without special equipment not yet available. Therefore, in a contaminated atmosphere, the chest-pressure arm-lift (modified Silvester) method is the preferred method of artificial respiration. For a description of this method, see FM 21–11.

Section XIV. POISONING

218. General

a. Dilution and Lavage. The principal point to be remembered in the treatment of poisoning is that the poisons, when diluted, are not absorbed as rapidly as when they are in concentrated form. Therefore, when a person has taken poison, dilute the poison as quickly as possible. Use water or milk. In addition to diluting the poison it should be cleaned out of the stomach either by vomiting or by stomach tube. There are two types of poisons for which emetics or stomach tube are not used. These are strong acids and alkalies. In these two types of poisoning the esophagus may be corroded and there is danger of rupturing it.

b. Emetics. These are substances which cause vomiting either by chemical irritation or by stimulation of the vomiting center in the brain. The following emetics are useful in most types of poisoning.

(1) Mustard powder ------------------ 10 gm. (150 gr.)
dissolved in glass of water.
(2) Copper sulfate ------------------- 3 gm. (45 gr.)
dissolved in glass of water.
(3) Ipecac -------------------------- 0.5 gm. (8 gr.)
followed by glass of water.
(4) Tartar emetic -------------------- 5 mg. (1/12 gr.)
dissolved in glass of water.
(5) Apomorphine --------------------- 5 mg. (1/12 gr.)
given subcutaneously.
(6) Table salt ----------------------- 15 gm. (4 gr.)
dissolved in glass or two of warm water.

If vomiting does not occur, induce it by placing a finger down the throat. When the stomach has been well washed out, the specific antidote, if known, can be given. A large dose of magnesium sulfate can be safely given later to clean the gastrointestinal tract of any residual of poison.

c. The Universal Antidote. If the nature of the poison is unknown, repeated doses of a teaspoonful of the so-called universal antidote, stirred in water, may be given. The universal antidote is a mixture consisting of—

Pulverized charcoal ---------------------------------- 2 parts.
Tannic acid --- 1 part.
Magnesium oxide ------------------------------------- 1 part.

219. Treatment for Various Poisonings

a. Acids. Many acids are used in industry and the trades. Hydrochloric acid, commercially known as muriatic acid, is used for metal

cleaning, ore reduction and soldering acid. Battery acid is diluted sulfuric acid and also has many industrial uses. These cause intense pain in the mouth, throat, and abdomen, with partial destruction of the mucous membranes, intense thirst, difficulty in speaking and swallowing, bloody vomitus, constipation, and collapse. Hydrochloric acid stains skin and mucous membranes gray-white; mitric acid, brilliant yellow; sulfuric acid and oxalic acid, white to brown.

(1) Do not use stomach tube or emetics.
(2) Neutralize with an alkali such as magnesia, or lime water.
(3) Give demulcents (substances capable of soothing an inflamed or abraded mucous membrane or protecting it from irritation) such as milk, olive oil, or egg white.
(4) Keep patient warm.
(5) Give morphine for pain.

b. Alcohol.

(1) If patient is heavily intoxicated, give thorough gastric lavage or emetic.
(2) Apply warmth to extremities, and cold applications to head and neck unless in shock.
(3) Administer oxygen if there is respiratory depression.
(4) If outside the hospital, give such stimulants as warm coffee by mouth or rectum.
(5) Other stimulants include 0.75–1 gm. (10–15 gr.) of caffeine sodium benzoate given intramuscularly, or ephedrine sulfate given intramuscularly in doses of 30 mg. (½ gr.) every 2 hours.
(6) Position of the body should be changed frequently to prevent pneumonia.
(7) Apomorphine in doses of 6–10 mg. (1/10 to 1/6 gr.) can be given by a medical officer in cases of acute mania.

c. Alkalies. Representative of this group is sodium hydroxide, commonly known as lye. Symptoms are similar to acid poisoning.

(1) Do not use stomach tube or emetics.
(2) Neutralize with lemon juice, orange juice, or vinegar.
(3) Keep patient warm; give morphine for pain.

d. Ammonia. Breathing this gas causes conjunctival and corneal irritation; salivation, nausea, vomiting; purging, abdominal pain; choking sensation, cough, bronchial irritation, respiratory arrest, and pulmonary edema.

(1) Wash eyes thoroughly with water for at least 5 minutes.
(2) Give diluted solution of citrus fruit juice or other weak acid for gastrointestinal irritation.
(3) Artificial respiration and inhalation of oxygen under positive pressure for prevention of pulmonary edema.
(4) Give respiratory stimulants.

***Caution:* Avoid respiratory depressant narcotics.**

(5) For taking ammonia water internally, treat as for alkali (*c* above).

e. Acute Barbiturate Poisoning (Nembutal, Amytal, sodium amytal, seconal, and the like). This poisoning may be the result of individual susceptibility to a therapeutic dose, or it may occur following accidental or intentional consumption of a large amount of the drug.

(1) Keep airway clear; turn patient on side.

(2) Administer oxygen, or artificial respiration if necessary (par 216).

(3) Employ gastric lavage with the addition of small amounts of tannic acid and purgation with sodium phosphate (4 gm.).

(4) Apply external heat.

(5) Stimulants such as black coffee or caffeine sodium benzoate (1 gm.) are of value.

f. Acute Bichloride of Mercury Poisoning. Symptoms may include a metallic taste, choking sensation, epigastric pain, vomiting, purging of stringy mucus and blood, white shriveled tongue, suppressed urine, and shock. Procedure in the average human adult case is as follows:

(1) Employ gastric lavage, through stomach tube, with 5 percent solution of sulphoxylate, leaving approximately 200 cc. of this solution in the stomach.

(2) Immediately following this, 10 gm. sulphoxylate dissolved in from 100 to 200 cc. of distilled water is slowly injected intravenously during 20 to 30 minutes (by a medical officer).

(3) Four to six hours later, in severe cases, repeat intravenous injection of 5 to 10 gm. sulphoxylate.

(4) If colitis later develops, administer high colonic irrigations once or twice daily of 1:1,000 solution of sulphoxylate. Use only a purified product of sodium formaldehyde sulphoxylate, prepared in sealed ampules with exclusion of oxygen. Solutions used should be freshly prepared. If sulphoxylate is not available, use the following treatment:

(*a*) Give large quantities of egg white mixed with milk or water.

(*b*) Wash out stomach by stomach tube (par. 440).

(*c*) Administer 500 to 1,000 cc. of physiological salt solution intravenously at once.

(*d*) If there is evidence of shock, give a 500 cc. blood transfusion.

(*e*) Dimercapral (BAL) shoud be administered in a dosage of 3 to 5 mgm per kilogram of body weight intramuscularly followed by smaller doses at 2 to 4-hour intervals on

the first day and by reduced dosages over the next several days.

(*f*) If transfusion cannot be done at once, simultaneous intravenous injection of 500 cc. of 10 percent glucose and subcutaneous injection of physiological salt solution may be used as a temporary expedient.

(*g*) Give subsequent saline and glucose injections and transfusions in quantities and at intervals so regulated as to insure the presence in the body of a large, but not excessive, supply of fluid of nearly normal composition and to maintain *circulatory efficiency.* This may require 6 to 7 liters (or quarts) of fluid per day. However, if the urine output remains small despite seemingly adequate supplies of fluids, one must consider the mercury has caused kidney shutdown and *fluid intake must be restricted severely.*

(*h*) From the onset give no fluids by mouth so long as there is nausea or vomiting.

(*i*) If there is no diarrhea, rectal treatments are omitted. If there is diarrhea, a single, small, cleansing enema may be given daily. Discontinue the enema if it gives no relief.

g. Carbon Monoxide. See paragraph 215.

h. Opium (as morphine, codeine, heroin, laudanum, paregoric, and the like).

(1) Administer gastric lavage if the drug has been taken orally.

(2) Give Nalline (N-allylnormorphine), a specific chemical antidote for narcotic poisoning, in doses of 5 to 10 mg. intravenously. Repeat as necessary every 10 to 15 minutes but not to exceed 40 mg.

(3) Keep patient awake if at all possible.

(4) Give stimulants, preferably hot strong coffee.

(5) After danger passes, relieve constipation.

i. Phenols (carbolic acid, cresol, creosote, lysol). Symptoms include pain in the mouth, throat, and abdomen; intense thirst; difficulty in speaking and swallowing; brown or black vomitus; constipation; suppression of urine; profound collapse; odor of carbolic acid on breath; mucosa of the lips and mouth white and hardened; and boardlike abdominal muscles.

(1) If taken orally, use free gastric lavage with 10–20 percent alcohol.

(2) Apomorphine (5 mg.) may be given by a medical officer.

(3) Administer carbon dioxide and oxygen inhalation or artificial respiration (par. 216) if necessary.

(4) Stimulants such as caffeine may be given.

(5) If there is phenol on the surface, wash off with alcohol.

Section XV. HEAT CRAMPS, HEAT EXHAUSTION, AND HEAT STROKE

220. General

Troops exposed to high environmental temperature or to high temperature and high humidity are subject to three types of heat injury: *heat cramps*, *heat exhaustion*, and *heat stroke*. Any of these heat injuries can be disabling, but heat stroke can be fatal unless treated promptly and properly (par. 223). Therefore, it is extremely important for you to be able to distinguish heat stroke from the other types of heat injury.

221. Heat Cramps

a. Cause. Heat cramps are due primarily to lack of salt in the body due to insufficient salt intake and excessive loss of salt through sweating. Dehydration due to excessive sweating may also play a part in producing heat cramps.

b. Symptoms. The symptoms are painful cramps of skeletal muscles, chiefly the muscles of the abdomen and of the calf of the leg. The skin is pale, cool, and wet with sweat. The body temperature is normal.

c. Treatment. Heat cramps are relieved by replacing the salt lost from the body. To do this, give salt solution (0.1 percent) by mouth. This salt solution is made by dissolving salt in water as follows: (1) two 10-grain salt tablets in one canteen (one quart) of water; (2) one-fourth teaspoonful of table salt in one quart of water; (3) one-third pound of table salt to the Lyster bag (36 gallons) of water; and (4) one pound of table salt to 100 gallons of water.

222. Heat Exhaustion

a. Cause. Heat exhaustion results from circulatory failure brought on by excessive loss of water and salt from the body.

b. Symptoms. Heat exhaustion is manifested by headache, mental confusion, vertigo (dizziness), drowsiness, extreme weakness, and, in some cases, fainting. The skin is pale, cool, and wet with sweat. The oral temperature may be subnormal or slightly elevated. The rectal temperature is usually 99° to 101° F. Blood pressure is lowered. Pulse is weak and rapid.

c. Treatment. Heat exhaustion is relieved by getting the patient's circulation back to normal and by replacing the salt and water he has lost. Remove the patient to a cool place and put him in a horizontal position—lying down with his head level. Other measures that will help circulation are elevation of the feet and rubbing the arms and legs. Give large quantities of 0.1 percent salt solution, the same as in treatment of heat cramps (par. 221*c*). The salt solution

should be given by mouth as freely as the patient will take it. If the patient is unconscious, give saline solution intravenously. Loosen or remove the patient's clothing to help body cooling.

223. Heat Stroke

This condition is sometimes referred to as *sunstroke*. It is the most serious type of heat injury and has a high death rate. The most important feature of heat stroke is the extremely high temperature which accompanies it.

a. Cause. Heat stroke results from inadequate heat loss with overheating and damage to the heat regulating center in the brain.

b. Symptoms. There may be signs of impending heat stroke such as headache, dizziness, mental confusion, frequent desire to urinate, and diminished or absent sweating. Usually, heat stroke starts with sudden collapse and loss of consciousness leading to coma. The patient's skin is red (flushed), hot, and dry; there is absence of sweating. The body temperature is very high (105° to 110° F. rectally).

c. Treatment. The lowering of the patient's body temperature as rapidly as possible is the most important thing in the treatment of heat stroke. The longer the high fever continues, the greater is the threat to life. Measures to lower body temperature should be started immediately.

(1) Remove the patient's clothes. Immerse the patient in cold water, in ice water if available. If the water available is not enough to do that, sprinkle the patient thoroughly, and then fan him to quicken cooling evaporation.

(2) Rub the patient's arms, legs, and trunk to increase circulation to the skin.

(3) Remove the patient to a hospital as soon as possible. Always transport the patient in an opened vehicle, never in a closed ambulance. The passage of air currents through open doors and windows will aid cooling. Continue measures to cool the patient until the hospital is reached.

(4) Check the rectal temperature every 10 minutes. When it declines to 100° F., the cooling treatment should be stopped, for often the temperature will continue to fall and perhaps reach a dangerously low level.

(5) Salt solution may be given intravenously or subcutaneously. When the patient is able to drink, 0.1 percent salt solution should be given freely by mouth.

(6) If cyanosis (blueness of the skin) is present, oxygen should be given by face mask. In some cases, artificial respiration may be necessary.

224. Prevention of Heat Injury

The following measures are useful in the prevention of all types of heat injury.

a. Drink plenty of water. Whenever you sweat excessively, the water lost must be replaced. Drink small amounts of water at frequent intervals, such as every 20 to 30 minutes, throughout the work period. Under conditions of heavy sweating, an individual will require a pint or more of water per hour. Water and salt requirements are discussed in detail in TB Med 175.

b. Take extra salt when needed. The diet ordinarily contains enough salt, but when you sweat excessively you will need extra salt. You may expect excessive sweating on your first exposure to hot weather or, when you start a period of hard work during hot weather. If you become dehydrated, take extra salt when you replace your deficiency of water. A convenient way to do this is to salt drinking water to a concentration of 0.1 percent (par. 221*c*).

c. Work during the cool hours of the day. Rest and keep in the shade during midday hours. Plan your work so that you get enough sound sleep.

d. Allow about one week to adjust your body to work in a hot environment. When you are first exposed to hot weather or to work in extreme heat almost any job will be hard. Each day you will be able to increase the working time, and the work will seem easier.

e. Eat your heavy meal in the evening when the weather is cooler rather than at noon. Food, especially protein, increases the amount of heat which you produce and which you must lose.

f. Dress to suit the weather. Clothing should be loose fitting, especially at the neck, wrists, and ankles, to allow circulation of air. In the direct sunshine, clothing will protect you from solar radiation. At other times in a hot environment, you will be cooler wearing the least allowable amount of clothing.

g. When heat stress is severe or physical exercise is strenuous, be extra careful to avoid heat injury. Short periods of work alternated with short periods of rest are safest.

h. One attack of heat stroke predisposes the individual to a second attack. A person once stricken should be cautious about further exposure to excessive heat.

Section XVI. COLD INJURIES

225. Trench Foot

a. Description. Trench foot is an injury resulting from prolonged exposure of the feet to wetness and cold at temperatures from just above freezing to 50° F. It is usually associated with long periods of standing or keeping the feet still. Tightness of the shoes or socks also favors its development. It is similar to "immersion foot," an injury caused by prolonged immersion of the feet in cold water. Trench foot is seen mostly among troops who have been living in the cold, mud, and dampnes found in foxholes and trenches. The period

of exposure varies from a few hours to 14 days. With proper care and equipment, trench foot can be prevented.

b. Symptoms. Some patients may have no symptoms. Usually, there is an uncomfortable feeling of numbness in the feet. They feel wooden; walking seems clumsy and difficult. There may be a tingling, aching sensation or a cramping pain. If the shoes are removed, the feet will swell, the amount of swelling depending upon the amount of exposure. If the exposure has been prolonged and severe, the feet may swell so tightly that pressure closes the blood vessels and cuts off the circulation. Unless treatment is prompt, gangrene develops and part or all of the foot may be destroyed.

226. Frostbite

a. Description. Frostbite is the freezing of tissue in a localized area. It occurs as the result of exposure to cold at temperatures below 25° F., especially if there is a strong wind (table V). The period of exposure varies from a few minutes to several hours. Frostbite is aggravated by fatigue, starvation, and poor circulation. Poor circulation can be caused by tight clothing or by becoming chilled when not enough clothing is worn.

b. Symptoms. There is an uncomfortable coldness in the injured part followed by a feeling of numbness which is sometimes accompanied by a stinging, aching pain. The skin is first red, then pale or waxy white. While frozen, the injured part has no feeling. In severe cases edema and hemorrhage may occur when the part is thawed. Often on thawing the skin looks severely burned. Prolonged exposure to cold causes the individual to become numb and drowsy. His eyesight fails, and he becomes unconscious. Respiration may stop.

227. Emergency Treatment of Cold Injuries

a. All wet or tight clothing such as boots, gloves, and socks, should be removed from the injured part.

b. The injured part *if still frozen* should be rewarmed by immersion in warm water (90°–104° F.), by placing a warm hand on the part, or by exposure to warm air. Do not rewarm by walking, massage, exposure to open fire, cold water, or rubbing with snow.

c. General body warmth should be maintained. Cover the patient with blankets but do not put them over the injured part.

d. The patient should be evacuated early. All patients with cold injuries involving the feet should be treated as litter cases.

e. Blisters should be left unopened. They should be covered with a loose, dry dressing to protect the injured part and to maintain warmth. Do *not* apply ointment or vaseline gauze dressings.

f. Treatment with antibiotics (penicillin) should be started and a booster dose of tetanus toxoid given.

g. The injured parts must be handled gently and protectively. The parts must be protected against *pressure necrosis* because they will not have normal sensation.

228. Prevention of Cold Injuries

Either trench foot or frostbite can disable large numbers of troops in a short time. Usually these cold injuries are preventable. Prevention is based on two things. One is conserving body heat. The other is avoiding prolonged exposure of troops to cold, wind chill, moisture, and other factors that favor the production of cold injuries.

a. Wind Chill. Wind chill plays an important part in the production of cold injuries. This is indicated by table V, which indicates the rate of cooling of exposed flesh resulting from wind speeds and temperatures. Table V can be used for prior planning. Instructions for use of the table follow:

(1) Get the temperature and wind speed forecast.

(2) Locate the number in the table at the top corresponding to the expected windspeed (or the number closest to it).

(3) Read down this column until you reach the number corresponding to the expected temperature (or the number closest to it).

(4) From this point read across to the right on the same line until you reach the last number under the column marked zero (0) windspeed. This is the equivalent temperature reading. *Example:* a weather forecast gives the expected temperature (at a given time) to be 35° F. and the expected windspeed (at the same time) to be 20 mph. Locate the 20 mph. column at the top, read down the column to the number nearest 35° F. The nearest number is 34° F. From this point, read to the right on the same line and find the last number, which is —38° F. This means that with a temperature of 35° F. and a wind of 20 mph., the rate of cooling on exposed flesh is the same as —38° F. with no wind. At temperatures above 32° F., deep or superficial freezing of tissues will not occur regardless of equivalent wind chill temperature.

b. Prior Planning. Upon the approach of cold weather, troops who are to be exposed should be given adequate clothing and taught how to avoid cold injuries. Commanding officers of the troops must anticipate this situation and recognize its seriousness. Medical personnel must be ready with advice and methods of prevention and treatment.

c. Clothing. It is important that footgear be *loose fitting* and *waterproof.* Socks or stockings should be large enough that they do not bind the feet. In fact, not only footgear but other items of clothing—underwear, sweaters, jackets, and trousers—should be loose

Table V. Wind Chill—Equivalent Temperatures on Exposed Flesh at Varying Windspeed

Windspeed (mph)	45	35	25	20	15	10	5	3	2	1	0
Temperature in degrees Fahrenheit.	90	89.5	89	88.5	88	88.7	87.5	87	86	84.5	83
	82	81	80.5	80	79.5	78	76	74	72.5	70	60
	72	71	69.5	68	67	65	60	57	53.5	47.5	23
	63	61	59	57	55	52	44.5	39	34.5	20	−11
	51	49	47	45	42.5	38	28	18.5	11	0	−27
	41	39	36	34	30.5	25	11	0	−9	−23	−38

enough to avoid constriction of any part of the body. Constriction impedes circulation and favors the development of cold injury.

d. Care of the Feet. Good equipment is wasted if the feet are not properly cared for. As much as possible men should avoid standing in water or mud. The feet must never stay wet. Dry socks should be put on each day. During periods of exposure the feet should be exercised and elevated whenever possible. If it is impossible to walk about, walk in place, or clench and unclench the toes with the boot.

e. Inspections. It is important to have frequent inspections for good personal hygiene especially of the feet. There should be a daily inspection by squad or platoon leaders together with the company aid men. Inspections serve not only to find early signs and symptoms of cold injuries but also to impress the troops with the importance and danger of the conditions.

f. Rotation of Troops. Troops should be rotated frequently from areas where exposure to cold, wet weather is continuous or severe.

Section XVII. BITES

229. Snake Bite

a. Poisonous snakes are found nearly everywhere in the world where the climate is warm and mild. Of the 2500 known species, less than 200 are potentially dangerous. These species are among five families and subfamilies, namely: (1) Hydrophidae or sea snakes, which by habit and environment rarely are a source of danger to man; (2) Colubridae, which contains the majority of known species but in which 'rear fanged' snakes (seldom found outside of Africa) are the only poisonous species; (3) Viperidae, or true vipers, found in the Old World but not in the Americas or Asia; (4) Crotalidae, or pit vipers, found in the New World and in Asia; (5) Elapidae, represented by the coral snakes and cobras, found everywhere except Europe.

b. Four kinds of snakes are common to North America. These are rattlesnakes, copperheads, water moccasins, and coral snakes. The

first three belong to the pit vipers, so called because of a deep pit between the eye and nostril on each side of the head. Pit vipers have stout bodies, thin necks, and flat triangular heads. The coral snake is small and slender, usually less than 3 feet long, with black and red bands divided by narrow yellow bands encircling the body. Poisonous snakes have teeth arranged in two rows with a pair of fangs in the front of the upper jaw (fig. 98). The fangs have either a groove or a canal through which a poison is injected when the snake bites. Nonpoisonous snakes have four or six rows of teeth without fangs. Thus, the bite of a poisonous snake leaves a pattern of marks different from that left by the bite of a nonpoisonous snake (fig. 98). Snake venom contains two kinds of poison: *neurotoxin*, which causes paralysis, shock, and respiratory failure, and *hemolysin*, which breaks down red blood cells and injures blood vessels. Some snakes have more of one poison than the other. For example, coral snake venom is mostly neurotoxin, while rattlesnake venom is largely hemolysin. Most snake venoms produce moderate to severe local pain and rapid swelling in the area of the bite. Blisters and local discoloration of the tissues may develop due to the necrotizing (tissue killing) effect of the venom. The pit vipers are noted especially for these effects on bitten tissues.

c. Symptoms of Poison Snake Bite.

(1) Severe pain.
(2) Swelling.
(3) Purple discoloration of the skin.
(4) Shock and weakness.
(5) Paralysis and respiratory failure.
(6) Tetanus may follow.

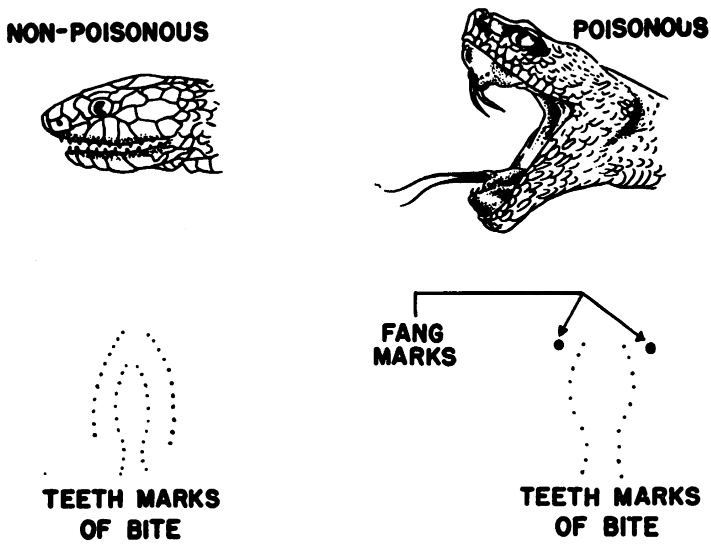


Figure 98. Patterns of bite of poisonous and nonpoisonous snakes.

(7) Death may occur during the first 24–36 hours.

d. Treatment of Poison Snake Bite. See FM 21–11.

230. Insect Bites

a. Black Widow Spider Bite. The most poisonous spider is the black widow. It is found in practically all parts of the world. The black widow spider is identified by its jet black color and the red hourglass-shaped marking on the abdomen. The bite causes severe pain and violent muscle cramps, especially of the abdomen, with fever and sweating. Wash the area of the bite with soap and water. Apply tetracaine ophthalmic ointment to reduce local pain. Give fluids by mouth but do not give morphine. The patient should be attended by a medical officer without delay.

b. Tarantula Bite. The tarantula spider is not as poisonous as the black widow spider. Tarantula bite is painful and can cause local infection. Apply tetracaine ophthalmic ointment to reduce pain. If infection occurs, use hot compresses.

c. Scorpion Stings. Ordinary scorpion stings are not severe. Symptoms are pain at the site of the sting, blister formation, and weakness or numbness in the affected part. An ordinary sting is treated with tetracaine ophthalmic ointment or pontocaine ointment to relieve local pain or by cold packs to reduce bodily absorption of venom. A person stung by a scorpion on the face, neck, or genital organs should receive the immediate attention of a medical officer.

d. Tick Bite. Ticks often are carriers of disease. They should be removed before they have been attached to the body as long as 2 hours. In removing a tick, be careful not to crush it or leave the head in the skin. Ticks may be removed by pulling with small forceps or they may detach themselves if insect repellent or heat is applied. Bite wounds should be treated with tincture of iodine or other antiseptic.

e. Bee, Wasp, or Hornet Stings. Remove the stinger from the wound. Apply a compress of dilute ammonia water or baking soda paste. Antihistamines may be helpful.

231. Dog Bite

Dog bite is dangerous chiefly because it may transmit rabies (hydrophobia), a fatal disease caused by a virus carried in the saliva of rabid animals. Emergency treatment of the bite is as follows: wash the wound thoroughly with soap and water, apply a sterile dressing, and give the patient a booster dose of tetanus toxoid. The patient should be attended by a medical officer without delay. If avoidable, the dog should not be killed. It should be caught and turned over to the veterinary officer for quarantine and observation. If the dog must be killed, its head should be taken to the nearest medical laboratory to be tested for rabies. If the dog is found to be rabid, the pa-

tient must receive the Pasteur treament, otherwise he will develop rabies in 20 to 60 days. Foxes, wolves, cats, squirrels, bats, and other animals may also be carriers of rabies, therefore if available, the biting animal, dead or alive, should be saved for examination for rabies.

232. Human Bites

Human bites are prone to infection. Often a bite carries highly pathogenic bacteria from the mouth into the tissues through a penetrating and poorly drained wound. The hand is the most common site of human bites. Treatment should be prompt, with thorough washing of the wound and removal of devitalized tissue. The wound should be left open, the hand dressed and put at rest, using splints if necessary. Tetanus toxoid or antitoxin should be given. Antibiotics are used also.

Section XVIII. HYPERSENSITIVITY

233. Description

Hypersensitivity is an abnormal chemical and physical reaction with characteristic symptoms that occur in some persons upon contact with certain substances which ordinarily are harmless to most persons. A person is said to be allergic or hypersensitive to any of these substances to which his body over-reacts. If he eats, inhales, or touches a substance to which he is sensitive, his tissues react irritably, sometimes violently.

234. Allergies

Allergy is the name given to the hypersensitive state in man. The variety of allergic reactions is numerous and the variety of substances that produce reactions seems almost countless. Also each substance may manifest its allergy in a variety of reactions. For example, penicillin allergy may be manifested by hives, angioneurotic edema, skin eruption, asthma, or a reaction resembling serum sickness. Many of these substances (*allergens*) are proteins. Substances capable of acting as allergens include inhalants, such as pollens, dusts, vapors, and cosmetics; foods, such as eggs, milk, nuts, and pork; contact agents (touched by the skin), such as plants, flowers, chemicals, and insecticides; and drugs, such as aspirin and penicillin (see *i* below). Some persons are sensitive to the bacteria that grow in their noses and throats. The common disorders described below are caused by allergic reactions.

a. Asthma is caused by spasm of the smooth muscle in the small bronchioles of the lungs due to the presence of an allergen. In asthma the muscle fibers around the bronchial tubes contract to narrow the tubes, and mucous membrane inside the tubes swells. The

result is the air passages are narrowed so that air can get in and out of the lungs only with difficulty. The allergen causing asthma usually is inhaled or ingested.

b. Hayfever (allergic rhinitis) is the reaction of mucous membranes in the nose and eyes to allergens in the air. Most of these allergens are plant pollens; thus hayfever is usually a seasonal condition.

c. Hives (urticaria) is a reaction of the skin to form itching welts. Ingested or injected allergens usually are the cause.

d. Angioneurotic edema (giant hives) is the swelling of tissues, especially about the face and throat, due frequently to an ingested or injected allergen. This disease is dangerous when the swelling involves the tissues of the throat. It may cause the patient to suffocate.

e. Eczema (atopic dermatitis) is due to allergic reaction.

f. Contact dermatitis is caused by allergens which act upon contact with the skin.

g. Migraine (severe one-sided headache) is thought by some authorities to be caused by an allergic reaction.

h. Serum allergy is a reaction in man caused by hypersensitivity to the injection of animal serums. These serums are used in the treatment of such diseases as tetanus and diphtheria.

(1) If a dose of serum is injected into a normal person, usually nothing happens that can be seen. During the next few weeks the person may become sensitized. If a second dose of serum is injected later in the person's life, a violent reaction may occur. Generalized collapse, severe urticaria, high fever, and even death have been caused by this allergic reaction.

(2) Because of the possibility of sensitivity to serum, it is always necessary to give each person a skin test before injecting serum. A small test dose of the serum (0.1 cc. of 1 to 10 dilution) is injected into the skin. Abnormally severe inflammation of the site of injection is the sign of sensitivity.

(3) One common type of serum allergy, known as serum sickness, is a delayed reaction to the use of serums. About 10 days after serum treatment a patient may develop fever, skin rash, discomfort in the joints, and in general may feel quite miserable. Ordinarily this condition does not last more than a few days.

i. Skin eruptions are common types of allergic responses to many drugs. Some drugs which commonly manifest an allergic response by skin eruptions are barbiturates and antibiotics, including penicillin.

235. Emergency Treatment of Allergies

a. Severe Angioneurotic Edema.

(1) *General.* This condition is usually caused by a person ingesting, or receiving by injection, a substance to which he is violently allergic. The reaction may be prompt and dramatic. The face, especially about the eyes and lips, becomes swollen. If the tissues of the throat are involved, swelling of the air passage may cause suffocation. Usually the person knows and will tell you what has happened to him.

(2) *Treatment.* Treatment at its best is frequently unsatisfactory but the condition will regress spontaneously.

(*a*) Ephedrine 0.025 to 0.05 gm. three times a day by mouth has been found in some cases to lessen or even abolish the symptoms.

(*b*) Cold applications may be temporarily beneficial.

(*c*) When the tissues of the throat are involved, the patient should immediately be given an injection of 0.5 cc. of a 1:1,000 solution of epinephrine (adrenalin). This may be repeated if necessary. If danger of suffocation cannot otherwise be averted, it may be necessary to cut open the trachea (tracheotomy) below the larynx.

b. Asthma.

(1) *General.* A patient in severe asthmatic attack will usually tell you what his trouble is. He sits, leaning forward, breathing with his mouth open. Breathing is very difficult. It is necessary for him literally to force the air from his lungs and it escapes with a straining, wheezing sound.

(2) *Treatment.* Inject 0.5 cc. of a 1:1,000 solution of epinephrine (adrenalin). Ephedrine sulfate may be given by mouth (25 to 50 mg.). Its action is similar to epinephrine but it requires half an hour to take effect. Aminophylline in doses of 3¾ to 7½ grains may also be given (*slowly* and intravenously) if epinephrine has had no effect. Oxygen or a mixture of 75 percent helium and 25 percent oxygen, if available, may be given as an inhalation.

c. Serum Allergy.

(1) *General.* This is caused by injection of a serum to which the patient is sensitive (par. 234*h*). The onset of the symptoms usually follows very shortly after the injection of the offending serum. There is palpitation, difficulty in breathing, and fever. There may be swelling of the face and itching of the skin. The reaction may appear with explosive suddenness and severity.

(2) *Treatment.* Prevention is nearly always possible. Serum should never be given without first skin testing. If the person is sensitive, the serum should not be given until he is desensitized. This is a complicated and dangerous procedure involving the injection of many small but increasingly larger doses of serum. The treatment for serum allergy, if it does develop, is to inject 0.5 cc. of epinephrine (adrenalin) and repeat if necessary to control the symptoms. Serum should never be injected unless there is a syringe of adrenalin on hand ready for use.

Section XIX. REMOVAL OF FOREIGN BODIES

236. General

All injuries of the ear, nose, or eye are potentially serious. Improper care can cause further damage to an injured eye, ear, or nose. Therefore, emergency medical care of these injuries should be limited to the bare essentials. All but the most minor cases of eye, ear, or nose injury should be evacuated for definitive care by a medical officer.

237. Foreign Bodies in the Ear

The only safe method of dislodging a foreign body from the ear is to syringe the ear canal with lukewarm water. In syringing the ear be sure to direct the force of the flow of water along the side of the ear canal and not in the direction of the drum. If the object does not come out, leave the ear alone until it is seen by a medical officer. Never use pins or wire to dislodge these objects, as there is great danger of seriously injuring the ear. An insect in the ear may be removed by attracting it with a flashlight held to the ear or it can be killed by dropping in a little water and then washing out the ear. Do not irrigate with water if a bean or similar object is lodged in the ear canal; the object may swell and cause further injury.

238. Foreign Bodies in the Nose

These usually present no immediate danger. The object can often be dislodged by stoppage of the unaffected nostril and blowing of the nose. Any attempt to remove the object with forceps or wire usually causes more swelling and lodges the foreign body more securely.

239. Foreign Bodies in the Eye

a. These are the most frequent type of eye injury. They are dangerous and require careful treatment. Do not rub the eye. To do so may embed the foreign object in the eyeball. Do not try to remove the object with the fingers. Close the eye for a few minutes until

the spasm of irritation is over, then grasp the lashes of the upper lid and raise the lid. This will cause tears to flow, often washing out the foreign body.

b. If the above method fails, look on the inside of the lower lid for the foreign body. Place the thumb below the eye and gently pull down. This exposes the under surface of the lower lid for examination (fig. 99). If the foreign body is seen there, it can be picked off with a cotton tipped stick. If it is not seen, examine the upper lid. To examine under the upper lid, have the patient look

Figure 99. Examining lower eyelid.

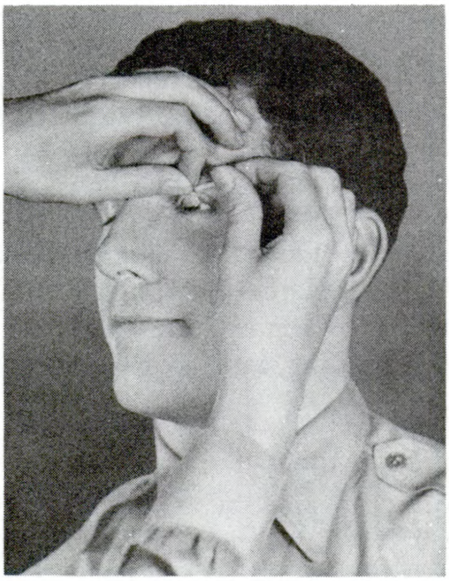


Figure 100. Examining upper eyelid.

down, place a match across the upper lid, and then with the other hand grasp and raise the lashes, turning the lid back over the match (fig. 100). Lift out the foreign body with a cotton tipped swab stick. If indicated, boric acid ophthalmic (eye) ointment may be placed on the inside of the lower lid (fig. 101) and the eye may be patched (fig. 102).

c. If the object is embedded in the eye or lid, or if there is difficulty in removing it, close the eye, cover it with an eye patch held

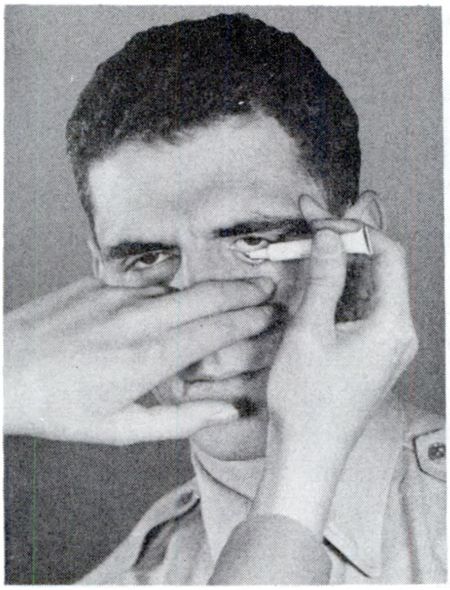


Figure 101. Use of eye ointment.

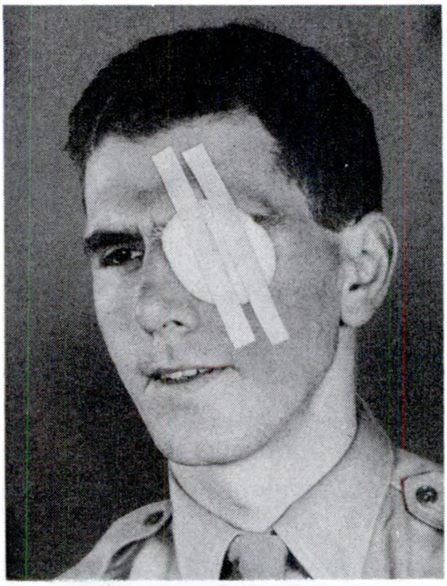


Figure 102. Eye patch applied over eye.

in place with adhesive tape (fig. 102) and consult a medical officer as soon as possible. *Do not* use a knife, toothpick, pin, or similar object to remove something from the eye. The eye is easily damaged and may be injured or infected by wrong procedures.

Section XX. COMBAT PSYCHIATRY

240. General

The discussion in this section is limited to the normal combat reaction and to combat exhaustion, its cause, recognition, and emergency treatment. For more information on psychiatric treatment in combat areas, see TM 8–244.

241. Combat Exhaustion

a. Definition. Combat exhaustion is a transient emotional reaction or disturbance resulting from the psychological and physical stress of battle which is sufficiently severe to cause the soldier to be ineffective in combat.

b. Use of the Term. Uniform use of the term "combat exhaustion" is important. It is the standard diagnostic term for chronic or acute psychiatric casualties and is to be used generally to designate these casualties. Such terms as "shell shock" and "psychoneurosis" are not to be used as diagnostic descriptions. These terms are misleading to the patient and to medical service personnel who treat him. Formal diagnostic psychiatric terminology such as "psychoneurosis" or "psychosis" indicates long term illness and can be alarming to medical personnel as well as to the patient who reads it on his emergency medical tag. To both these terms, especially the "psycho" part, may imply an incurable mental illness. However, the soldier is not likely to misinterpret the term "combat exhaustion." The word "exhaustion" suggests a temporary condition, something that can be overcome in a short time. The word "combat" indicates the exhaustion originated in battle.

c. Cause. A basic component of combat exhaustion is fear. The soldier in battle is afraid of being mutilated, being killed, and of losing control of his emotions. Combat exhaustion occurs when, because of lowered morale, physical exhaustion, or wounds, loss of confidence in cause, in leadership, or in weapons, or overwhelming psychic trauma, the soldier finds he can no longer adequately cope with these anxieties and develops symptoms which are disabling. Any soldier may become a psychiatric casualty if he is subjected to too intense combat, or if he is kept in combat longer than he can tolerate these fears.

242. Defenses Against Combat Exhaustion

a. Personality Structure. The average soldier has a relatively stable personality which enables him to adjust effectively to severe stress when he is in a unit with good morale. However, all persons do not have the same capacity of adjustment to stress. Some individuals are more susceptible to emotional breakdown than others are.

b. Group Identification. One of the most important defenses against combat exhaustion is group identification, or group unity. This is the emotional bond which develops among individuals who share hardship and danger. The soldier gets a feeling of security by identifying himself with and being part of his unit. The practical results of this identification are better morale, stronger motivation toward duty, increased ability for aggressive action, and less susceptibility to battle fear.

c. Physical State. Lowering of the physiological state of the body contributes to combat exhaustion. It is hard for a soldier to maintain emotional control when he is excessively tired, has gone without sleep a long time, has not had enough food, is wet and cold, or is weakened by an illness such as malaria or diarrhea.

d. Training. Proper training helps to prevent combat exhaustion in several ways. It improves the soldier's physical fitness, which in turn enhances emotional stamina. It gives him the technical knowledge he needs to do his job in combat. It teaches him how to protect himself. These things reduce the effects of fear.

e. Leadership. The ability of a combat unit to succeed in its tactical job and to sustain its members against emotional breakdown depends to a great extent upon its leader. The leader sets the standard and motivation for his men by example and behavior. From these actions, the men determine their need to tolerate discomfort and danger.

243. The Normal Combat Reaction

To be afraid in combat is normal. Almost all soldiers experience some symptoms in reacting to battle stress. Although the symptoms may seem abnormal to the soldier who has them, they lie within the range of the normal reaction to battle fear and physical fatigue. The symptoms are of two types, physical and psychological.

a. Physical Symptoms.

(1) *Muscular tension.* It is normal for muscular tension to increase under battle stress. This may be reflected in an individual as headache, shaking and tremor, backache, and the like.

(2) *Sweating.* Excessive sweating on the hands and in the armpits is a normal response to combat stress. Some soldiers

may feel chilly, while others feel too warm. Sometimes these sensations alternate and soldiers mistake them for chills and fever.

(3) *Nausea.* Nausea and loss of appetite for food are normal responses to battle stress, as are abdominal cramps and diarrhea.

(4) *Other symptoms.* Increased frequency of urination is a common normal response to battle stress. Another normal response is tachycardia (excessively rapid heart beat).

b. Psychological Symptoms. These include apathy, lack of drive and initiative, weariness, sensitivity to noise, irritability, insomnia, and a feeling of apprehension or impending doom.

244. Types of Combat Exhaustion

a. Mild Combat Exhaustion. The distinguishing feature of the mild combat exhaustion casualty is his inability to function as a frontline soldier, that is, to perform those duties necessary to sustain himself and his unit in combat. Patients of this type make up about 70 percent of the combat exhaustion cases seen at battle group aid stations. From the way they look to other persons, these patients often cannot be distinguished from men with the normal combat reaction. Usually, patients with mild combat exhaustion can be recognized by what they say or by their mood, or character of mental state. Sometimes they show characteristic physical exhaustion or complain of bodily symptoms similar to those of normal combat reaction (par. 243). They talk about their fear or tension. They make statements of surrender because of fear or tension. Their mood is that of mild depression or of tearfulness. They may be cold, wet, or physically exhausted by several days of fighting without enough sleep or food. Up to 65 percent of these patients may be returned to full duty after treatment in the aid station.

b. Moderate Combat Exhaustion. The characteristic symptom of the moderate combat exhaustion casualty is his inability to perform as a soldier, that is, carrying out the functions normally expected of a soldier, whether he is on the front lines or in areas to the rear. Patients of this type make up about 25 percent of the combat exhaustion cases. These patients really look sick. They show outward signs of disabling tension, such as trembling, crying, and abnormal sensitivity to noise. They may show loss of motion or of some other major voluntary function. They may be unable to talk about their fear and experiences in combat. They are usually physically exhausted. They cannot be expected to perform effectively in combat. Requiring definitive treatment which the aid station cannot provide, the moderate combat exhaustion cases are evacuated.

c. Severe Combat Exhaustion. These patients comprise about 5 percent of all combat exhaustion cases. Patients with severe combat exhaustion show disruption of personality to the extent of complete loss of contact with reality. No longer can they function as human beings. They may be excited and panicky, mute (speechless), or delusional, seeing or hearing things that do not exist. These cases require prompt evacuation. Excited patients may be so agitated that they require physical or chemical restraint.

245. Treatment of Combat Exhaustion

Treatment of combat exhaustion is based upon the following principles:

a. Treatment of patients as far forward and as promptly as possible. The farther forward these patients are treated the greater are the chances for returning them to duty. The first level of treatment for combat exhaustion casualties is the combat unit. Medical aid men, fighting comrades, and officers of the units can supply the needed fuel to sustain or replenish the emotional needs and to reduce feelings of fear. It may be necessary, when unit morale and leadership are ineffective, to evacuate some casualties to the battle group aid station where the battle group surgeon and his aid men provide medical care, adequate rest and food, reassurance, and physical hygiene. The patient should not remain at this station longer than 48 hours.

b. Relief of physical fatigue and effects of exposure by such restorative measures as provision for rest and sleep with or without sedation (as indicated by the patient's state of anxiety and tension), hot food and hot drinks, and a change of clothes. Every attempt should be made to begin these measures as promptly as possible.

c. Relief from psychological stress. An interview with a medical officer is important to the patient. It allows the patient to ventilate his fear and feelings about his battle experiences. In addition, the interview gives the medical officer an opportunity to evaluate the patient's condition, to explain his symptoms, and to reassure him.

d. Prompt return of patients to duty. Early return to duty is the best thing for the soldier as well as his organization. It keeps the soldier from getting feelings of guilt and losing identification with his fighting group. It helps to maintain the fighting strength of the soldier's unit, which must go short-handed until he returns or until he is replaced.

CHAPTER 5

PHARMACOLOGY AND MATERIA MEDICA

Section I. INTRODUCTION

246. General

To furnish effective emergency medical care and treatment, you need to know how to use common drugs, particularly the basic drugs contained in field medical sets (sec. VI, this chapter). You also need to know something of the sources of drugs, their properties, methods of administration, action on the body, toxicology, and dosage.

247. Definitions

a. Pharmacology. This is the science of drugs, especially the actions of drugs on the body, including materia medica and therapeutics. No drug can introduce a new action in the body; all that any drug can do is modify actions which are already there. Drugs can either increase or decrease the actions or functions of cells.

b. Materia Medica. This is the branch of medical science which deals with the source, properties, preparation, and doses of drugs.

c. Therapeutics. This subject deals with the actions of drugs in the treatment of disease.

d. Drug. A drug is any substance, or mixture of substances, used in the treatment, prevention, or diagnosis of disease.

e. Poison. A poison is a substance which when absorbed or ingested into the body may alter physiology to a mild or a critical extent by damaging body tissues or cells.

f. Toxicology. This is the study of poisons, their actions, the treatment of poisoning, and the use of antidotes (pars. 218 and 219).

g. Pharmacy. This is the art and science of preparing and dispensing drugs for medical purposes. Pharmaceutical is the adjective which means pertaining to pharmacy.

h. USP. The United States Pharmacopeia is the official reference on the source, preparation, potency, and doses of commonly used and valuable drugs.

i. NF. The National Formulary is an official companion reference to the USP. It contains many less commonly used drugs and preparations not included in the USP. It designates their sources, methods of preparation, standards of purity, and dosage.

j. Official Drug or Preparation. An official drug or preparation is one that is listed in the USP or NF.

k. NND. This abbreviation refers to *New and Nonofficial Drugs.* It is a book published annually by the American Medical Association giving the characteristics and doses of newly developed drugs that have not yet been accepted by the USP or NF.

248. Prescription

a. Definition. A prescription is an order written by a physician or a dentist to a pharmacist, directing him to supply a patient named in the prescription with the quantities of drugs specified. Directions for the use of the drugs are given by the physician or dentist and written on the container by the pharmacist. A prescription is a legal document and must be signed.

b. Parts. A prescription consists of—

(1) Date on which it was written.

(2) Name of the patient and his ward or military organization.

(3) The symbol ℞, an abbreviation of the Latin word "Recipe" meaning "Take thou. . . ."

(4) Names and quantities of the drugs. Names may be written in English or Latin; amounts in the metric system. Army prescriptions are written in English with amounts in the metric system.

(5) Instructions to the pharmacist.

(6) Instructions to the patient. These should always be written in English.

(7) The signature of the physician.

249. Abbreviations and Symbols Used in Prescriptions

Abbreviations commonly used in prescriptions and elsewhere in pharmacy are given in appendix III. Most are Latin words or phrases abbreviated as shown.

Section II. TYPES OF DRUGS AND VEHICLES

250. General

Drugs are compounded into various types of preparations depending upon their (the drugs) physical characteristics, the purpose for which intended, and the method by which they are to be administered. Some drugs are prepared in more than one form so they may be administered several ways. To give them bulk or form, drugs may be mixed with other substances. These substances, which have no action or medicinal value, are called *vehicles.* For a drug in aqueous solution, water is the vehicle; for a drug in an ointment, the ointment base is the vehicle.

251. Types of Drug Preparations

a. Solid Preparations (fig. 103).

(1) *Powder.* A drug which is ground up and used in powder form.

(2) *Pill.* Powdered drug molded into spheres from a plastic mass.

(3) *Capsule.* A drug placed in a gelatin container.

(4) *Tablet.* A drug compressed or molded into a small disk.

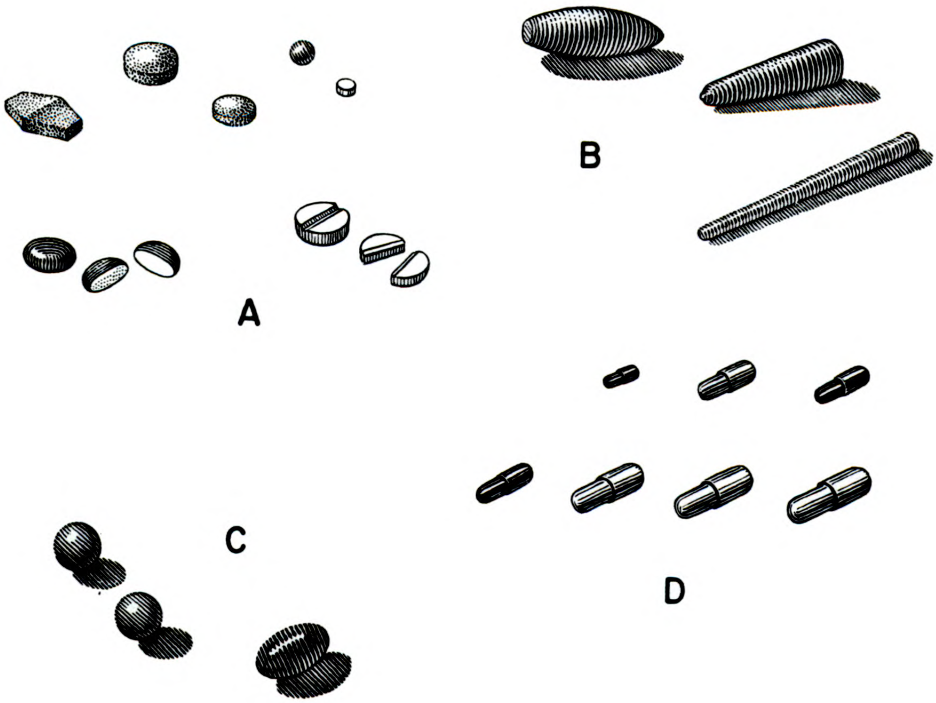
(5) *Suppository.* A drug which is molded into shape for insertion in a body opening and which melts or dissolves at body temperature.

(6) *Ointment.* A drug suspended in lard, vaseline, lanolin, or other solid or semisolid base, intended for external application.

b. Fluid Preparations.

(1) *Fluid extract.* A concentrated fluid preparation 1 cc. of which contains the alcoholic or hydroalcoholic extract of 1 gm. of the crude drug.

(2) *Tincture.* Alcoholic or hydroalcoholic solution or extraction of a drug. Tinctures of potent vegetable drugs are 10 per-



A. Pills and tablets.
B. Rectal supporitories.
C. Soft gelatin capsules.
D. Hard gelatin capsules.

Figure 103. Solid preparation of drugs.

cent in strength; of nonpotent vegetable drugs, 20 percent in strength.

(3) *Emulsion.* A mixture of two liquids, usually oil and water, one of which is dispersed as minute droplets in the other.

(4) *Syrup.* A highly concentrated sugar solution containing a flavoring agent into which a drug may be incorporated.

(5) *Elixir.* A solution containing alcohol, sugar, and flavoring substance in which one or more drugs may be dissolved.

(6) *Spirit.* An alcoholic solution of volatile drugs.

(7) *Liniment.* A solution of drugs in a soapy, oil, or alcoholic base, intended for external application, being applied with friction.

(8) *Suspension.* A liquid preparation containing undissolved material. A "shake well" label is applied to the container.

(9) *Ampule.* A sterile preparation of a drug placed in a sealed glass container.

(10) *Lotion.* An aqueous preparation, usually containing suspended insoluble matter, to be applied externally.

Section III. ADMINISTRATION OF DRUGS

252. General

Administration of drugs and medicines deals with the various ways by which they are applied to the body for local effect, or introduced into the body for systemic or for general effect. Some drugs may be used either way.

253. External Administration

External, or local, application of a drug is usually made for the effect it will have on the skin or mucous membrane of the area. Sometimes such an application is made for its effect in underlying tissues. The preparations most commonly used are:

a. Solutions. These are applied locally as antiseptics, cleaning agents, astringents, vasoconstrictors, and counterirritants. Solutions are also used as wet dressings, mouthwashes, gargles, and irrigations. Since solutions evaporate, the effect produced is often temporary.

b. Ointments. These provide the best means of applying drugs for a prolonged local effect, and are most commonly used. The drug is mixed in a fatty material such as lard, petrolatum, or lanolin, which becomes soft or liquid when warm but does not evaporate. Thus the drug is kept in contact with the body for a long period. Ointments are not used on discharging wounds because they prevent free drainage.

c. Suppositories. These are used generally in the rectum, urethra, or vagina. The drug is mixed with a solid substance, such as cocoa butter, which melts at body temperature. While in the solid form the mixture is shaped into cones so that they can be easily inserted.

After insertion, the cocoa butter melts, and the drug is absorbed by the mucous membrane of the cavity.

254. Internal Administration

Drugs may be given internally by several methods. When they are so given, the effect may be upon the whole body, or in one of the systems, or only at the site where the drug is administered. The common methods of internal administration are:

a. Oral. The most common way to give a medicine is by mouth, either in solid or liquid form. Giving a drug by mouth is the simplest way; it requires no special apparatus; it is painless; and absorption takes place in a natural manner. Furthermore, if a patient is sensitive to the drug, the stomach can be washed out or the patient induced to vomit so as to prevent further absorption.

b. Rectal. Medications are given by rectum for the purpose of evacuating the colon; for local treatment of a diseased rectum or colon; and for general absorption. To induce a bowel movement, drugs may be given by an enema. Irrigations may be used to medicate the mucous membrane of the rectum or colon. Rectal suppositories also are frequently used. Another method by which substances are administered through the rectum is *proctoclysis.* Fluid is allowed to run into the rectum slowly, drop by drop, so that it is absorbed and does not enlarge the rectum. The disadvantages of rectal administration are the uncertainty of absorption and the chance that the drug may be expelled.

c. Inhalation. Medications are administered by inhaling them into the lungs. This may be done by inhalation of medicated steam, by sprays, and by use of inhalators. Drugs given by inhalation include medications for respiratory infections and diseases, oxygen, and certain general anesthetics.

d. Intranasal. A long, slender cylinder of cotton may be saturated with a drug, such as epinephrine, and placed into the nose by nasal forceps. Liquids may also be instilled in the nose by a dropper or an atomizer.

e. Sublingual. A tablet or drop of medicine is placed under the tongue and held there until it is absorbed. It is not swallowed. The action of drugs given in this way is rapid.

f. Injection. A sterile injection is used when rapid action by the drug is desired, when the drug might be destroyed by digestive juices or vomited if given by mouth, or when the patient is unconscious or injured so that he cannot be given the medication by mouth. There are six ways in which drugs may be injected.

(1) *Subcutaneous* (fig. 104). The drug is injected by a hypodermic syringe and needle into the tissue just beneath the skin. A preparation for hypodermic use must be a sterile liquid, capable of complete absorption or it will irritate the

tissues. For most drugs the subcutaneous dose is about one-half the oral dose. Although the subcutaneous injection may be given in almost any area of the body, the usual sites are the lateral (outer) aspect of the upper arms and the anterior (front) of the thighs.

(2) *Intramuscular* (fig. 104). The drug is injected into a muscle, usually in the buttocks, sometimes in the upper arm or the thigh. The needle is inserted, at right angle to the skin, through the skin and subcutaneous tissue into the underlying muscle. This method gives more rapid absorption of the drug than subcutaneous injection gives.

(3) *Intravenous* (fig. 104). Sterile solutions of drugs are injected with the bevel of the needle up, into a vein in a slanting direction toward the heart. Drugs administered by vein act very rapidly because the whole dose passes at once into the bloodstream. If a large amount of fluid is injected drop by drop, it is called an intravenous infusion (par. 470).

(4) *Intraspinal*. Drugs are injected into the spinal canal. This method may be used by a medical officer for injection of immunologic serums, tetanus antitoxin, or penicillin. Spinal anesthesia also is done in this manner.

(5) *Intradermal* (fig. 104). The drug is injected into the skin rather than under it. This is often done as a test for drug

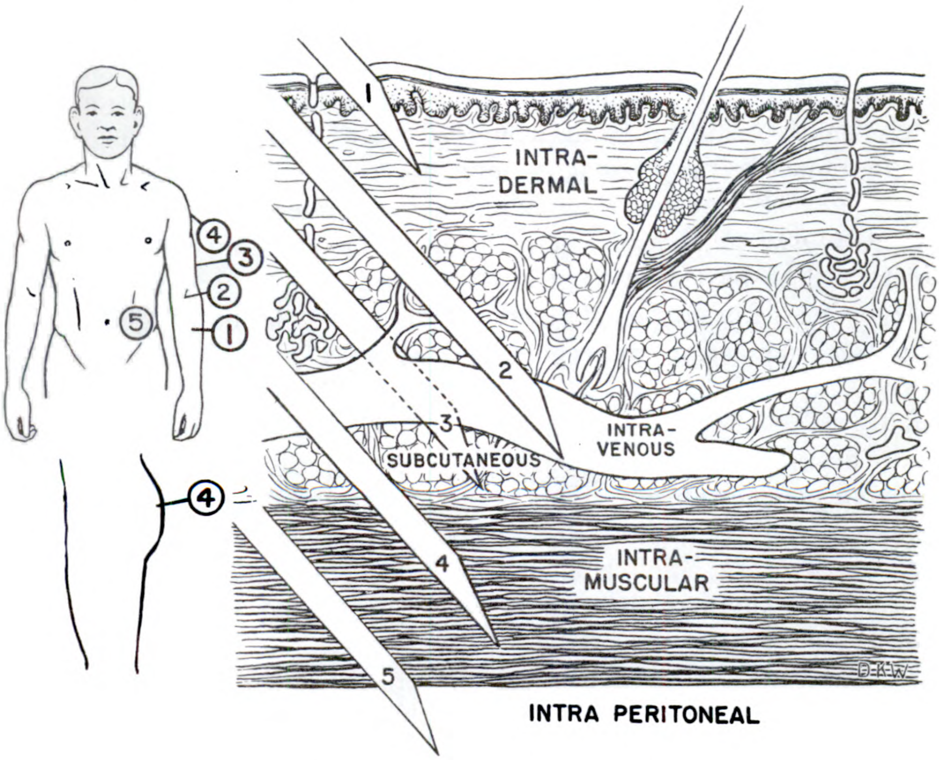


Figure 104. Sites of injections.

sensitivity before injecting larger doses by another method (fig. 147).

(6) *Intraperitoneal* (fig. 104). Occasionally, medicine is given directly into the peritoneal (abdominal) cavity by a syringe and needle. Drugs given in this way are absorbed rapidly by the peritoneum, the lining of the abdominal cavity.

255. Factors Influencing Dosage and Action of Drugs

Experience has shown that people usually react to similar drugs in similar ways. But the relationship is not a simple one. Drugs are complex and so are people. Putting the two together requires caution and wisdom. Ideally a definite dose of a drug should have a definite action in an individual. But this is not always the case. Many factors influence the action and dosage of a drug. Some modifying factors are discussed below.

a. The Drug. The potency of a drug may be altered by the age of the drug; the form it is in; or the way in which the drug is given. All these things can modify the action of a given dose of a drug.

b. The Patient. The body weight, sex, age, physical or emotional condition of the patient may affect the action of a drug. A heavy person requires more of a drug than a small person. A man usually requires more of a drug than a woman. Old people and children sometimes require less than the usual dosage of a drug because of sensitivity to it.

c. Idiosyncrasy. This means an unusual response to a drug which is different from its characteristic pharmacological action.

d. Tolerance. Tolerance is a lack of sensitivity to the action of a drug, usually resulting from prolonged use of a drug. If this occurs, the dose must be progressively increased to get a desired effect. Tolerance may be acquired for morphine and numerous other drugs.

e. Antagonistic Action. When some drugs are used together their effects will be partly or wholly neutralized. These drugs are called *antagonists.* For instance, morphine depresses the bowel and so antagonizes the action of vegetable cathartics which stimulate the bowel.

f. Cumulative Effect. Sometimes, after administration of a number of doses, a drug accumulates, or builds up, in the body and continues to produce effects. This is due to the inability of the body to dispose of the drug as rapidly as it is being given.

g. Habituation. This is emotional dependence upon a drug. Barbiturates are among the drugs whose prolonged use can produce habituation.

h. Addiction. Addiction is a condition developed in man in which continued use of drug is necessary for the body to function normally. Among the drugs which may produce addiction are morphine and other drugs described by law as narcotics.

i. Side Reactions. A drug given for a certain effect on a system of the body may have other effects, sometimes undesirable, on other systems. These are called *side reactions* or *side effects.* For example, morphine acts with desirable effect when given to relieve severe pain, but causes such side effects as constipation and difficulty in urinating.

Section IV. CLASSIFICATION OF DRUGS

256. General

Drugs are classified according to—

a. Their source.

b. Their therapeutic actions on the body.

c. The system of the body on which they have their effect.

257. Sources of Drugs

There are five main sources from which drugs are obtained.

a. Mineral. Many mineral substances found in nature are used in drugs. *Examples:* sulfur, zinc oxide, and magnesium sulfate (Epsom salt).

b. Plant. Certain drugs are derived from vegetables and plants. *Examples:* quinine, cascara sagrada, and morphine.

c. Animal. The organs or tissues of animals are the source of some drugs. *Examples:* liver extract, hormones, and antitoxic serums.

d. Synthesis. Many drugs are prepared synthetically in laboratories. *Examples:* aspirin, sulfonamides, and barbiturates.

e. Fungi and Bacteria. Some drugs are derived from fungi or bacteria. *Examples:* penicillin and vaccines.

258. Therapeutic Actions of Drugs

Drugs are classified by their therapeutic actions, that is, their actions on the body which are beneficial in the treatment of disease. The drugs so classified below are those contained in common field medical sets. They are discussed in detail in section VI, this chapter.

a. Analgesics. These are drugs which relieve pain. Acetylsalicylic acid (aspirin), morphine, and codeine are analgesics.

b. Anesthetics. These are drugs used to produce either a general loss or a local loss of pain sensation. Ether and thiopental sodium are examples of general anesthetics. Tetracaine, lidocaine hydrochloride, procaine hydrodchloride, and eugenol are examples of local anesthetics.

c. Antacids. These are drugs which neutralize excess acid in the stomach. Sodium bicarbonate and bismuth subcarbonate are examples of antacids.

d. Antibacterials. These are drugs which stop the growth of bacteria. Sulfadiazine and sulfacetamide sodium are antibacterials.

e. Antidotes. Antidotes are drugs which act on poisons to make

them harmless. Examples are the universal antidote (par. 218*c*) and starch, the antidote for iodine.

f. Antifungals. These are drugs which check the growth of fungi. Examples are fungicidal foot powder and undecylenic acid ointment.

g. Antihistamines. These are drugs which counteract the effects of histamine, a substance which dilates capillaries and increases gastric flow. When a foreign substance is introduced into the body, the body releases histamine. Further exposure to the substance is likely to cause the patient much discomfort. For that reason, an antihistamine—such as diphenhydramine hydrochloride—is given.

h. Antiparasitics. These are drugs used to eliminate paraistes (lice and mites). Examples of antiparasitics are gamma benzene hydrochloride ointment, ammoniated mercury ointment, and DDT powder.

i. Antiseptics. These are drugs which prevent the growth or development of bacteria. Alcohol, benzethonium chloride, benzalkonium chloride, meta cresylacetate, and potassium permanganate are classified as antiseptics.

j. Astringents. These are drugs which produce shrinkage of the mucous membrane or other tissue and cause a decrease in the amount of secretion from it. Calamine lotion and zinc oxide ointment are astringents.

k. Cathartics. Cathartics are drugs which quicken and increase evacuation of the bowels (defecation). A *laxative* is a mild cathartic. A *purgative* is a severe cathartic. Cascara sagrada, liquid petrolatum, and magnesium sulfate are cathartics.

l. Counterirritants. These are drugs which cause irritation of the skin, thus increasing circulation and relieving inflammation in the structures beneath. Methyl salicylate is a counterirritant.

m. Disinfectants. These are drugs or chemical agents which kill infectious organisms by contact. They are strong antiseptics. Examples of disinfectants are creosote, carbolic acid, and benzalkonium chloride tincture (zephiran).

n. Emollients. Emollients are drugs used to soften or to soothe the skin. Petrolatum is an emollient.

o. Hypnotics. Hypnotics are drugs which induce sleep. Morphine, phenobarbital, and secobarbital are hypnotics.

p. Inhalants. These are drugs whose fumes are inhaled to relieve bronchial irritation or congestion. Benzoin tincture compound is an inhalant.

q. Mydriatics. These are drugs which dilate the pupil of the eye. Homatropine hydrochloride is a mydriatic.

r. Sedatives. These are drugs which overcome excitement. Phenobarbital, secobarbital, and morphine are sedatives.

s. Stimulants. Stimulants are drugs which cause an increase in the activity of an organ or a system. Epinephrine is a heart stimu-

lant. Dextro amphetamine sulfate is a central nervous system stimulant.

t. Vasoconstrictors. These are drugs which constrict (draw together) blood vessels. Epinephrine and phenylephrine hydrochloride are vasoconstrictors.

259. Systemic Classification

Drugs are classified also by the system of the body upon which they act. Drugs which normally will be available to you affect the five systems discussed below.

a. Drugs Used on Skin and Mucous Membrane. These drugs, or local applications, include astringents, antiseptics, local anesthetics, emollients, counterirritants, antifungals, and antiparasitics.

b. Drugs That Act on Gastrointestinal Tract. Antacids and cathartics are among the drugs used to exert their main action on the digestive system.

c. Drugs That Act on the Respiratory Tract. These drugs include inhalants, stimulants, and depressants.

d. Drugs That Act on the Heart and Blood Vessels. The heart stimulants and vasoconstrictors are among the drugs in this group.

e. Drugs That Act on the Nervous System. These drugs are the analgesics, anesthetics, hypnotics, narcotics, and sedatives.

Section V. PHARMACEUTICAL MEASUREMENTS

260. Weights and Measures

Two systems of weights and measures are used in the practice of pharmacy. These are the *metric* system and the *apothecary* system. The metric system is the official system used by the Army. The metric system is used in the United States Pharmacopeia, the National Formulary, and New and Nonofficial Drugs. For converting measurements between these two systems see table VI.

These approximate dose equivalents represent the quantities usually prescribed, under identical conditions, by physicians trained, respectively, in the metric or in the apothecary system of weights and measures. In labeling dosage forms in both the metric and the apothecary systems, if one is the approximate equivalent of the other, the approximate figure shall be inclosed in parentheses.

When prepared dosage forms such as tablets, capsules, pills, etc., are prescribed in the metric system, the pharmacist may dispense the corresponding approximate equivalent in the apothecary system, and vice versa, as indicated in table VI.

***Caution:* For the conversion of specific quantities in a prescription which requires compounding, or in converting a pharmaceutical formula from one system of weights or measures to the other, exact equivalents must be used.**

Table VI. Metric Doses With Approximate Apothecary Equivalents

Liquid measure		Liquid measure	
Metric	Approximate apothecary equivalents	Metric	Approximate apothecary equivalents
1,000 ml	1 quart.	3 ml	45 minims.
750 ml	1½ pints.	2 ml	30 minims.
50 ml	1 pint.	1 ml	15 minims.
250 ml	8 fluid ounces.	0.75 ml	12 minims.
200 ml	7 fluid ounces.	0.6 ml	10 minims.
100 ml	3½ fluid ounces.	0.5 ml	8 minims.
50 ml	1¾ fluid ounces.	0.3 ml	5 minims.
30 ml	1 fluid ounce.	0.25 ml	4 minims.
15 ml	4 fluid drams.	0.2 ml	3 minims.
10 ml	2½ fluid drams.	0.1 ml	1½ minims.
8 ml	2 fluid drams.	0.06 ml	1 minim.
5 ml	1¼ fluid drams.	0.05 ml	¾ minim.
4 ml	1 fluid dram.	0.03 ml	½ minim.

Weight		Weight	
Metric	Approximate apothecary equivalents	Metric	Approximate apothecary equivalents
30 Gm	1 ounce.	30 mg	½ grain.
15 Gm	4 drams.	25 mg	⅜ grain.
10 Gm	2½ drams.	20 mg	⅓ grain.
7.5 Gm	2 drams.	15 mg	¼ grain.
6 Gm	90 grains.	12 mg	⅕ grain.
5 Gm	75 grains.	10 mg	⅙ grain.
4 Gm	60 grains (1 dram).	8 mg	⅛ grain.
3 Gm	45 grains.	6 mg	1/10 grain.
2 Gm	30 grains (½ dram).	5 mg	1/12 grain.
1.5 Gm	22 grains.	4 mg	1/15 grain.
1 Gm	15 grains.	3 mg	1/20 grain.
0.75 Gm	12 grains.	2 mg	1/30 grain.
0.6 Gm	10 grains.	1.5 mg	1/40 grain.
0.5 Gm	7½ grains.	1.2 mg	1/50 grain.
0.4 Gm	6 grains.	1 mg	1/60 grain.
0.3 Gm	5 grains.	0.8 mg	1/80 grain.
0.25 Gm	4 grains.	0.6 mg	1/100 grain.
0.2 Gm	3 grains.	0.5 mg	1/120 grain.
0.15 Gm	2½ grains.	0.4 mg	1/150 grain.
0.12 Gm	2 grains.	0.3 mg	1/200 grain.
0.1 Gm	1½ grains.	0.25 mg	1/250 grain.
75 mg	1¼ grains.	0.2 mg	1/300 grain.
60 mg	1 grain.	0.15 mg	1/400 grain.
50 mg	¾ grain.	0.12 mg	1/500 grain.
40 mg	⅔ grain.	0.1 mg	1/600 grain.

Note. A milliliter (ml.) is the approximate equivalent of a cubic centimeter (cc.)

The above approximate dose equivalents have been adopted by the latest Pharmacopeia, National Formulary, and New and Nonofficial Remedies, and these dose equivalents have the approval of the Federal Food and Drug Administration

261. Precautions in Handling and Dispensing Drugs

a. Store narcotics and poisons properly.

b. Keep no unidentified substance in the dispensary.

c. Be accurate in reading labels on drugs. Read the label three times: when you take the drug from the shelf, when you dispense the drug, and when you put it back on the shelf.

d. Keep labels clean and legible. When pouring from a bottle, keep the label toward the ceiling. This prevents spilling onto the label.

e. When pouring caustic liquids such as lye or ammonia, keep the container below eye level, and avoid spilling and splashing. Be extra careful in handling caustic liquids.

f. Give close attention to materials being heated. Do not leave the process unattended. Use heat-resistant glass containers or metal containers made for heating. Never heat alcohol over an open flame.

g. Keep flammable liquids in as small a supply as possible. This reduces the possibility of a big, damaging fire.

h. When handling tablets, capsules, or liquids which come in a variety of strengths or which resemble other products in color, size or shape, use special care in filling orders for them.

i. Do not stand over the container when pouring acids or alkalis. The fumes are dangerous to the eyes and mucous membranes.

j. To avoid contamination of drugs, weigh or count out solid preparations on weighing papers. Mix liquids in clean containers.

k. When handling drugs which give off explosive fumes, do so only in well-ventilated areas. The same precaution applies to the handling of liquids which emit irritating fumes.

l. Do not smoke while working with drugs. This precaution helps maintain cleanliness and prevents an explosion if volatile liquids are in the area.

m. Wrap glass tubing in a towel before you twist, pull, or push it. If tubing breaks, shake glass particles out of the towel before putting it aside.

n. When mixing an acid with water, add the acid to the water, not the water to the acid. If done slowly, this method of mixing will prevent painful acid burns.

o. Be sure that the provisions of AR 40–615 pertaining to drug laws and pharmacy management procedures are followed.

Section VI. DOSES AND USES OF DRUGS IN FIELD MEDICAL SETS

262. General

a. Drugs discussed in this section are those contained in the following sets: the surgical instrument and supply set, individual; the

surgical instrument and medical supply set, combat; and the medical instrument and supply set, dispensary, field.

b. In all cases, drugs are presented first under nonproprietary names. In some cases, the nonproprietary name is followed by a second name, either a trade name or another common name.

263. Acetylsalicylic Acid (Aspirin)

Aspirin acts an an analgesic and an antipyretic. As an analgesic, it relieves pain. As an antipyretic, it reduces the temperature in fever, but does not affect normal body temperature. It is used to relieve headaches and muscular pain and to reduce fever. Aspirin normally is issued as 0.324 gm. (5 gr.) tablets in bottles. Often aspirin is combined with other analgesics, such as phenacetin and caffeine (APC). The usual dose of aspirin (acetylsalicylic acid) or of APC is one or two tablets orally every 4 hours.

264. General Anesthetics

General anesthetics are central nervous system depressants which produce deep unconsciousness, thus causing loss of pain sensation throughout the body. The degree of pain loss depends upon the depth of unconsciousness.

a. Ether. Ether is used to produce surgical anesthesia. In addition, it is sometimes used to clean the skin for smallpox vaccination or similar injection. Ether is issued in small cans. It is highly flammable and should be stored in tight, light-resistant containers distant from fire.

b. Thiopental Sodium (Pentothal). Thiopental sodium is a barbiturate. It is used (injected intravenously) when a fast-acting general anesthetic is desired. Dosage of the drug should be determined by a medical officer. Thiopental sodium normally is issued in 0.5 gm. ampules packaged in boxes. Water is provided to put the drug into solution for injection.

265. Local Anesthetics

These drugs produce anesthesia in a limited area around the site of their injection or application by preventing transmission of pain impulses along the sensory nerves.

a. Lidocaine Hydrochloride (Xylocaine). This drug normally is supplied as a 2 percent solution for injection. It is about twice as potent as procaine hydrochloride. It is used for local anesthesia in dental and general surgical procedures. The dose of lidocaine hydrochloride is determined by a medical officer. Often it is combined with epinephrine to prolong the anesthetic action. When supplied as a jelly, it can be applied topically to produce local anesthesia.

b. Procaine Hydrochloride (Novocaine). This drug normally is supplied in an ampule as a 1 percent solution for injection. It is one of the least toxic injectable local anesthetics. Often it is combined with epinephrine to prolong its effect. As with all local anesthetics, you should avoid injecting procaine hydrochloride into a vein. The amount and strength of the drug to be used will vary with the method of inducing local anesthesia. However, the 1 percent solution is one of the common strengths used.

c. Tetracaine Hydrochloride (Pontocaine). This drug normally is supplied as ophthalmic ointment, 0.5 percent, in a tube. It is used in the eye to relieve local pain due to infection or injury. It does not dilate the pupil of the eye or cause other noticeable side effects. To apply the ointment, squeeze a small amount from the tube onto the affected area.

d. Eugenol (Oil of Cloves). Eugenol is a surface anesthetic and an antiseptic. It is used in dentistry to disinfect root canals and to give temporary relief from toothache. Eugenol is supplied in a bottle for topical application.

266. Antacids

a. Sodium Bicarbonate (Baking Soda). This drug normally is supplied as 0.6 gm. (10 gr.) tablets. It is given orally to treat excess acidity of the stomach, to reduce gastric irritation of aspirin and other drugs, and to make urine alkaline when sulfonamides are given. The usual dose of sodium bicarbonate as an antacid is 1 to 4 gm. given up to 4 times daily. When used with sulfonamides, the dose is 4 gm. initially, followed by 2 gm. every 4 hours.

b. Bismuth Subcarbonate. This drug normally is supplied as 0.324 gm. (5 gr.) tablets. It acts as an antacid and astringent. It is used to neutralize excess acid in the stomach and to treat diarrhea. The usual dose of bismuth subcarbonate is 1 gm. given 4 times a day.

267. Sulfonamides

a. Sulfadiazine. This synthetic drug is one of the least toxic, most useful sulfonamides. It stops the growth of bacteria and, in certain cases, kills bacteria. It is used to treat intestinal, urinary, and respiratory infections. The usual adult dose of sulfadiazine is about 400 gm. initially, followed by 1 gm. three times a day. With the first dose of sulfadiazine, 4 gm. of sodium bicarbonate should be given. With each additional dose of sulfadiazine, 2 gm. of sodium bicarbonate should be given. This is done to produce an alkaline urine, which prevents formation of sulfadiazine crystals that would block the kidneys. In addition, large amounts of water should be given with sulfadiazine to prevent kidney damage.

b. Sulfacetamide Sodium Ophthalmic Ointment (Sulamyd). This ophthalmic ointment, 30 percent, normally is supplied in small tubes.

It is used in the treatment of those infections of the eye which will respond to sulfonamide therapy. They include blepharitis, conjunctivitis, and styes. The dose is a small amount of ointment squeezed from the tube onto the infected area of the eye. The ointment should not be used in the presence of penetrating wounds of the eyeball. Another precaution to remember is that only ophthalmic ointments are suitable for use in the eye. Regular topical ointments may only cause more irritation if used in the eye.

268. Antifungal Agents

a. Undecylenic Acid Ointment (Desenex). This ointment is packaged in 1-ounce tubes. It is used to treat fungus infections of the feet (athlete's foot), ringworm, and fungus infection of the crotch. The best time to apply this fungicidal ointment is at night.

b. Fungicidal Foot Powder. This powder normally is supplied in 1-ounce cans. It is dusted onto the skin in treatment of fungus infections of the skin, especially athlete's foot. It should be applied during daytime, preferably at the beginning of the day.

269. Diphenhydramine Hydrochloride (Benadryl)

This drug normally is supplied as 50 mg. (¾ gr.) capsules. It is an antihistamine (par. 258*g*) used to treat such allergic conditions as asthma, hay fever, hives (urticaria), contact dermatitis, and skin rashes due to penicillin or other drugs. The usual dose is 50 mg. given 3 or 4 times a day. The main side effect of this drug is drowsiness.

270. Antiparasitic Agents

a. Gamma Benzene Hydrochloride Ointment (Gexane). This ointment normally is supplied in 2-ounce tubes. It is for topical use against lice and the mites which cause scabies (itch). Usually one application of the ointment is enough. It is irritating to mucous membranes and should not be allowed to touch the eyes.

b. Ammoniated Mercury Ointment. This drug normally is supplied as a white ointment packaged in 1-ounce tubes. It is applied locally to treat such skin infections as ringworm, impetigo, and pruritus ani (intense itching at the anus). Ammoniated mercury ointment is highly poisonous when taken internally. It may cause dermatitis if rubbed into the skin too vigorously.

c. DDT Powder, 10 Percent. This powder is used to treat pediculosis, infestation by lice. It should be dusted on the hairy portions of the body and left there at least 24 hours. The treatment should be repeated after one week. The powder should also be dusted on the patient's clothing and bed clothing. After the delousing treatment the clothing should be changed and the infested clothing laun-

dered. The patient should be dusted again if he bathes between the two dustings.

271. Antiseptics

a. Alcohol, USP (Ethanol, Ethyl Alcohol). Alcohol normally is supplied in a 1-pint can. It is used mostly as an antiseptic and cooling rub. Topically, alcohol is applied in concentrations of 35 to 70 percent. Therefore, the original strength must be diluted. When alcohol is prescribed for internal use, only alcohol, USP, is to be given. Receipts and expenditures of alcohol must be accounted for in the narcotic and controlled drug register.

b. Benzethonium Chloride (Phemerol). This drug normally is issued as 250 mg. tablets. In a 1:1,000 aqueous solution, it is used externally as a general purpose antiseptic. This solution is made by dissolving four tablets of benzethonium chloride in one quart of water. In the nose and eye, the 1:1,000 solution is used, diluted with four parts of water.

c. Meta Cresylacetate (Cresatin). This drug normally is supplied in a 1-ounce bottle. It is used to treat infections of the ear, nose, and throat, and to disinfect root canals in dental work.

d. Potassium Permanganate. This drug is supplied as small, dark purple tablets (0.324 gm. or 5 gr.). It is used topically to treat certain skin infections. It is also used as an irrigating solution for the bladder and urethra. For topical application, concentrations of 1:500 to 1:10,000 are used. A 1 percent solution is used to treat athlete's foot. A 1:5,000 solution is used for irrigation of the bladder in treating urinary infections. A solution of 1:1,000 to 1:10,000 dilution is used for irrigation of the urethra. Be careful in handling potassium permanganate; it may explode on contact with organic or other oxidizable substances.

272. Astringents

a. Calamine Lotion. This drug is a suspension of zinc oxide in water. It normally is supplied in 2-ounce bottles. Calamine lotion acts as a mild astringent and antiseptic. It is used externally to protect the skin and to relieve itching in such conditions as rashes, ivy and oak poisoning, and chicken pox.

b. Zinc Oxide Ointment. This drug is a white, odorless ointment packaged in 1-ounce tubes. It is mildly astringent and antiseptic like calamine lotion, and has the same uses.

273. Cathartics

a. Uses. Cathartic drugs are used for—

(1) Constipation due to infrequency of defecation or the dryness and hardness of feces.

(2) Removal of irritative substances as in food poisoning and certain forms of diarrhea.
(3) Reduction of excessive tissue fluids resulting from kidney disorder, congestive heart failure, or head injury.

b. Precautions.

(1) Never give cathartics or enemas in acute appendicitis, typhoid fever, or any acute inflammatory conditions of the bowels.
(2) Do not give a cathartic or an enema after an operation unless it is ordered.
(3) Do not give cathartics soon after meals, for they may cause vomiting.
(4) In giving a cathartic, consider the length of time the drug takes to act, so that the patient's work or sleep is not needlessly interrupted by bowel movement.

c. Cascara Sagrada. Cascara sagrada is a laxative. It acts by the slow liberation of irritant derivatives in the intestines. Its action is mild and not accompanied by griping or discomfort. It normally is supplied as 0.25 gm. (4 gr.) tablets. Cascara sagrada is usually given at bedtime. The usual dose is one table (0.25 gm.).

d. Liquid Petrolatum (Mineral Oil). Liquid petrolatum is a mild laxative. It softens and lubricates the intestinal contents. By preventing absorption of water from the intestines, the oil increases the bulk of the contents. This enlarges the intestines, and bowel movements result. The usual adult dose of liquid petrolatum is 15 cc. (3 tsp.) once or twice a day. Continuous use of large amounts of liquid petrolatum should be avoided because some vitamins are soluble in oil. They are absorbed and excreted from the body with the oil.

e. Magnesium Sulfate (Epsom Salt). Magnesium sulfate normally is supplied in a 2½-pound can. It is an active cathartic when given orally. It is a mineral salt which draws water out of the tissues into the intestines. The water increases the bulk of the intestinal contents and the salt irritates the mucous membrane lining of the intestine, both effects causing increased bowel movement. This cathartic is best given in the morning when the stomach is empty. It usually acts in 1 to 2 hours, resulting in a watery bowel movement. The usual dose of magnesium sulfate is 15 gm. (4 dr.).

274. Benzalkonium Chloride Tincture (Zephiran, BAC)

A disinfectant, this drug normally is supplied in a 1:1,000 solution in 10-cc. vials contained in a package. Benzalkonium chloride tincture kills many pathogenic, nonspore-forming bacteria and fungi after several minutes exposure. In addition, it is a detergent, acting much like soap in removing dirt. It is used for prophylactic

(preventive) disinfection of the intact skin and to preserve the sterility of surgical instruments and rubber articles during storage. When using benzalkonium chloride tincture on the skin, let it dry before you apply a dressing. Do not use it with soap or in the preence of organic materials, for they will reduce its effectiveness.

275. Methyl Salicylate (Oil of Wintergreen)

Methyl salicylate is a counterirritant used in liniments to treat painful muscles and joints. For topical application, methyl salicylate is used in concentrations of about 10 percent. The drug is poisonous. It should be labeled "For External Use Only" and kept out of the reach of children.

276. Petrolatum (Petroleum Jelly)

Petrolatum is used on the skin as a protective dressing and as an ointment base. Normally it is supplied in ½-ounce tubes.

277. Benzoin Tincture, Compound

Benzoin tincture, compound, normally is issued in a 1-pint can. It is used in steam inhalations to relieve bronchial congestion and irritation. It is also used to protect the skin under adhesive strapping.

278. Barbiturates

These drugs are derivatives of barbituric acid. They are powerful depressors of the higher levels of the central nervous system.

a. Secobarbital Sodium (Seconal). Normally this drug is supplied as 0.1 gm. (1½ gr.) capsules. It acts as a sedative and a hypnotic. It is used as a preanesthetic medication and to induce sleep or to reduce nervousness. The usual hypnotic dose of secobarbital sodium for adults is 0.1 to 0.2 gm., and the usual sedative dose is 50 mg. As a preanesthetic agent, 0.2 to 0.3 gm. of secobarbital sodium is given ½ to 1 hour before the patient is sent to the operating room.

b. Phenobarbital (Luminal). This drug normally is supplied as 16 mg. (¼ gr.) and 32 mg. (½ gr.) tablets. It is classified as a longacting barbiturate. It is used as a sedative, hypnotic, and anticonvulsant. The usual dose of phenobarbital is 32 mg. given up to 4 times a day. Phenobarbital is excreted mainly by the kidneys. Therefore, it should be used cautiously in patients whose kidneys are not working properly.

279. Narcotics

Both narcotics discussed here, morphine and codeine sulfate, are derivatives of opium. Both depress the central nervous system. Both are constipating. Either may cause addiction (par. 255*h*). Both must be accounted for in the narcotic register.

a. Morphine. See paragraph 155.

b. Codeine Sulfate. This drug normally is supplied as 32 mg. (½ gr.) tablets. Codeine sulfate acts like morphine although it is much weaker. It is used to relieve moderate pain and to stop nonproductive cough (cough without sputum). For relief of pain, the usual dose of codeine sulfate is 32 mg. given every 3 or 4 hours. To stop a cough, the dose of codeine sulfate is 5 to 10 mg. Codeine sulfate should not be used when there is any sputum to be coughed up; stopping such a cough is not good for the patient.

280. Homatropine Hydrochloride

This drug normally is supplied as ophthalmic disks packaged in a tube. It is used to dilate the pupils of the eyes for examination. Dosage and application of homatropine hydrochloride disks should be directed by a medical officer. This drug is extremely poisonous.

281. Epinephrine (Adrenalin)

Epinephrine normally is supplied in a clear, sterile solution of 1:1,000 for injection. Epinephrine is extracted from the adrenal glands of domesticated animals and is made synthetically. It acts as a vasoconstrictor and a heart stimulant. Its effect on blood vessels is marked; whether epinephrine is applied locally or given systemically, the blood vessels contract. A wide white area develops at the site of injection of epinephrine. Some uses of epinephrine are to control hemorrhage, to prolong local anesthesia by delaying absorption, to treat nasal congestion, and to treat cardiac arrest. Epinephrine is inactive when taken orally. The 1:1,000 solution of epinephrine is given by subcutaneous or intramuscular injection, the amount determined by a medical officer. For topical application to check hemorrhage, as in nosebleed, concentrations of 1:1,000 to 1:10,000 are used. A 1 percent solution is used for inhalation. Epinephrine must be used cautiously in patients with cardiovascular disease or high blood pressure.

282. Phenylephrine Hydrochloride (Neo-Synephrine)

Phenylephrine hydrochloride is generally used in ¼ percent or 1 percent solution or in the form of a jelly for application to nasal membranes. Used in this manner the drug causes vasoconstriction and acts as a nasal decongestant. Phenylephrine hydrochloride should be use cautiously in patients with heart disease or high blood pressure.

283. Dextro Amphetamine Sulfate (Dexedrine)

Dextro amphetamine sulfate normally is supplied in 5 mg. tablets. A synthetic drug, it is a powerful stimulant of the highest centers of the central nervous system. The main uses of dextro amphetamine sulfate are to stimulate depressed or fatigued patients and as an ap-

petite depressant in the treatment of obesity (overweight). The usual adult dose is 5 mg. given 2 or 3 times a day. To control the appetite in obesity, the usual dose is 5 to 10 mg. taken ½ to 1 hour before meals. The last dose should be given at least 4 hours before bedtime. If given too late in the day, the drug may interfere with sleep. Dextro amphetamine sulfate should be used cautiously in patients with severe hypertension (high blood pressure). The drug should not be given to patients with heart disease or to excited patients.

CHAPTER 6

DISPENSARY MEDICAL SERVICE

Section I. INTRODUCTION

284. Dispensaries (AR 40–21)

a. Definition. A dispensary is a medical treatment facility designed primarily to provide outpatient examination and care for ambulatory patients, to treat emergency cases, and to arrange for the transfer of patients requiring bed care. Dispensaries also perform various administrative, preventive medical and sanitary activities related to the health of the personnel served.

b. Mission. Dispensaries are the first level of medical service for all military personnel except those troops actually engaged in combat operations. Dispensaries are not merely first aid or sorting stations, nor are they miniature hospitals. They are medical installations intended to provide proper diagnosis and treatment or transfer to hospital for inpatient bed care. Most individuals seeking medical care do not suffer from serious conditions requiring hospital treatment, but from minor sickness and injuries and from concern over personal health. If these individuals are returned to duty from the dispensary level without adequate examination, treatment, and reassurance, they continue to worry about their health, lose confidence in the Army Medical Service, and become less effective in their assignments. On the other hand, if they are needlessly hospitalized the seriousness of their conditions becomes exaggerated in their minds, there is unnecessary loss of duty time, and needless use of hospital personnel and facilities.

c. Activities. Some of the more important activities carried on by a dispensary are the following: sick call, emergency treatments, routine treatment of patients who do not require hospitalization, immunizations, physical examinations and physical inspections, maintenance of individual health records, filling prescriptions, and collection and classification of patients for transfer to hospital.

d. Personnel.

(1) *Dispensary surgeon.* The senior medical officer assigned to a dispensary is designated the dispensary surgeon. The surgeon is responsible for—

(*a*) Diagnosis and treatment or disposition of all persons coming to the dispensary for medical care.

(*b*) The administration of the dispensary including personnel, property, supplies, and records.

(*c*) Command function over personnel of the dispensary so far as pertains to the direct operation and efficiency of the dispensary. He is responsible for the adequate care and discipline of individuals coming to the dispensary while they are under his jurisdiction.

(*d*) The dispensary pharmacy, and its operation should be guided by AR 40–615 (see also ch. 5).

(*e*) Maintaining records and forwarding reports as required.

(*f*) Such miscellaneous functions of the dispensary and its personnel as may be required. He should work in cooperation with the post or unit medical inspector on matters relating to infectious disease incidence and control.

(2) *Assistant dispensary surgeons.* When more than one medical officer is assigned to a dispensary, the junior officers are designated as assistant dispensary surgeons. Their duties are such as the dispensary surgeon may assign to them.

(3) *Administrative officer.* Often the personnel of a dispensary includes a Medical Service Corps officer who serves as the administrative officer. This officer's duties are assigned by the dispensary surgeon. Usually, the Medical Service Corps officer is put in charge of the administration of the dispensary to include personnel management, records, reports, property, and supplies.

(4) *Senior medical noncommissioned officer.* The senior medical NCO supervises the enlisted personnel of the dispensary and is responsible for the physical maintenance of the dispensary and its equipment. He assists the surgeon in the medical training of the enlisted personnel, the supervision of medical records and reports, the requisitioning of supplies, the maintenance of property records, and the discipline of individuals present for medical attention.

(5) *Supply sergeant.* Occasionally a dispensary has a supply sergeant. He performs the supply and property duties normally done by the senior medical noncommissioned officer.

(6) *Medical specialists.* The medical specialists assist the surgeon in treatments done in the dispensary. They provide nursing care for individuals who remain on "quarters" status in the dispensary. They may assist the surgeon in physical examinations, sanitary inspections, and immunizations.

(7) *Pharmacist.* The pharmacist is the enlisted man charged with the operation of the dispensary pharmacy.

(8) *Clerk.* The clerk is in charge of medical records and assists in the preparation of reports and correspondence.

e. Arrangement of Dispensary. The dispensary should provide—

(1) A clerk's desk near the entrance.

(2) Waiting room.

(3) Examination rooms where medical officers may see each patient privately.

(4) Treatment rooms.

(5) Pharmacy.

(6) Bed accommodations. A dispensary may be equipped with beds (normally less than 25) for observation of patients awaiting transfer to a hospital, and for care of "quarters" type cases for not more than 72 hours.

(7) Storage space for equipment and supplies.

(8) Sleeping accommodations for the charge of quarters.

(9) Latrine.

f. Dispensary Equipment.

(1) A dispensary will be provided with the equipment needed to carry on its activities. In some instances, as in unit dispensaries (par. 285*b*), equipment will be provided as prescribed in applicable tables of organization and equipment. In other instances, a dispensary may function with equipment prescribed by a table of authorization or it may get its equipment by allocation from the commanding officer of the treatment facility.

(2) Nonexpendable items are accounted for in the company (or station) property book.

285. Types of Dispensaries

a. U.S. Army Dispensaries. These are *fixed* dispensaries, so called because they are intended to operate in the same location over a long period of time. Normally, established outside the combat zone, U.S. Army dispensaries are designed to provide medical service for personnel located in an Army installation, a large city, a military district, or a prescribed area.

b. Unit Dispensaries. These are dispensaries designed to provide primary medical service for troops in the field. They are called *nonfixed* dispensaries because they can move or be moved from place to place to provide medical support in tactical operations. Normally, each field medical unit will establish a unit dispensary to serve its parent field unit and any other field units attached to it for medical support. In a combat zone or under simulated combat conditions, the term "aid station" is used instead of dispensary.

286. Health Record (AR 40–403)

a. When an individual is at his station, his Health Record is filed and maintained in the dispensary, or other medical treatment facil-

ity, where he receives primary medical care. If he is hospitalized, the record is made available to the hospital.

b. The Health Record is a permanent, continuous file of records prepared for an individual as he receives medical or dental care. Each contact an individual has—as a patient—with medical service during his military career is recorded in his Health Record.

c. The key form of the Health Record is the Chronological Record of Medical Care. Each event involving medical care in a person's military health history is recorded on this form. For example, it is used when an individual attends sick call or receives other outpatient care. More detailed information on this form and other medical records and documents contained in the Health Record is given in paragraphs 36–39 inclusive.

d. A dispensary may provide outpatient care to military dependents, retired military personnel, and others for whom a Health Record is not kept. The basic record used in these cases is the Outpatient Medical Record prescribed by AR 40–425. Detailed information on the Outpatient Medical Record is given in paragraph 42.

Section II. SICK CALL

287. Sick Call (AR 40–101)

Sick call is a military formation of the sick and injured. It is held each day at a designated place and time, usually the early morning.

a. Individual Sick Slip. Each person who comes to the dispensary on sick call should present an Individual Sick Slip. The sick slip is prepared in the individual's unit orderly room. It is used to inform the unit commander of the status of a man of his command who has reported on sick call. After examination and treatment of the patient, the attending medical officer indicates the disposition of the patient on the sick slip, and it is returned to the unit commander. More information on the Individual Sick Slip and its uses is given in paragraph 43.

b. Purposes. The main purposes of sick call are—

(1) To provide medical attention at a certain hour each day for persons on a duty status.

(2) To provide for the admission to hospital or quarters for further examination and treatment of each person found to be physically unfit to perform full duty.

(3) To record in official records and reports any changes of status of patients.

c. Personnel Served. Sick call is a medical service provided for the personnel of a unit or station. Thus, sick call for the companies of a battalion having organic medical service is normally held at the

battalion dispensary; and sick call for other personnel on duty at a station is normally held at a station dispensary. However, the services of a dispensary are not to be arbitrarily restricted; personnel entitled to medical care by the Army will be treated in the most readily accessible, adequately staffed and equipped Army dispensary or hospital, regardless of command jurisdictions. Irrespective of status, no person requiring emergency medical treatment is denied the facilities of the Army Medical Service.

288. Holding Sick Call

The following is a typical system for holding sick call in a fixed dispensary. It may be changed and adapted to meet local conditions.

a. On arrival at the dispensary, individuals give their sick slips to the dispensary clerk. The clerk examines each slip to see if it contains the necessary information (the individual's name, service number, grade, and organization).

b. The clerk takes from the file each patient's Health Record for use by the attending surgeon. The date of the patient's appearance on sick call is entered in the patient's Chronological Record of Medical Care.

c. A specialist receives the Health Record from the clerk and questions the patient about his complaint or condition. The specialist also takes the patient's temperature and enters it in the Chronological Record of Medical Care. Any emergencies are referred immediately to the surgeon. The patient should have his temperature taken and recorded no matter what his complaint. The significance of almost any symptom will change if accompanied by an elevated temperature.

d. The Health Records are taken to the surgeon's examining room and given to the surgeon. He calls in the patients one at a time, questions them, examines them, and determines what treatment they are to have.

e. If the treatment procedure is one that can be carried out in the dispensary, it will be given either by the surgeon or, if he so directs, by a designated specialist.

f. If further diagnostic study is needed, and if this can be done while the patient is on a duty status, the surgeon directs the clerk to prepare appropriate forms requesting a laboratory, clinic, hospital, or other suitable installation to do this work (par. 289).

g. If the surgeon wants medicine dispensed to a patient, he writes a prescription and gives it to the patient, directing him to the dispensary pharmacist. If the medicine is not available in the dispensary, the patient may be instructed to take the prescription to a hospital pharmacy or to return to the dispensary after the pharmacist has obtained it.

h. The surgeon (or other individual) who treats the patient is required (AR 40–403) to enter certain information in the patient's

Chronological Record of Medical Care. Instructions for these entries are given in paragraph 39.

i. Patients requiring relief from duty are carried as "sick in quarters." An individual quarters record is prepared for each such case.

j. If it is necessary to hospitalize a patient the surgeon may direct the clerk to prepare an individual admission record as an instrument of transfer. This record goes with the patient to the hospital.

289. Additional Diagnostic Procedures on Duty Status

a. X-Ray Request. To get an X-ray consultation, the patient is sent to the X-ray laboratory with duplicate copies of a request for radiographic reports. The request should describe accurately the part to be examined and give at least a presumptive diagnosis so that the radiologist can photograph the part properly.

b. Laboratory Work. The following are examples of the way in which laboratory work may be requested by a dispensary.

(1) *Complete blood count (CBC).* Blood may be drawn in a dispensary and sent to the laboratory for white blood cell count, red blood cell count, hemoglobin determination, hematocrit, and erythrocyte sedimentation rate. About 5 cc. of blood is drawn by venipuncture, usually from a large superficial vein in the forearm, and placed in a bottle containing the anticoagulant ammonium and potassium oxalate. The blood should be shaken well in the bottle to mix it with the anticoagulant. The bottle is stoppered and is sent to the laboratory with two copies of the hematology request form.

(2) *Urinalysis.* The urine is collected in a clean bottle. The bottle is stoppered and sent to the laboratory with duplicate copies of the urinalysis request form. The urine must be examined while it is fresh for it decomposes on standing.

(3) *Feces examination.* Feces must be examined while fresh. For this reason it is best to send the patient to the laboratory with duplicate copies of the feces request form. If this is not practicable, a small amount of feces may be picked up on the end of a small wooden paddle, and feces and paddle both dropped into a clean glass tube. A screw-top tube should be used because feces may generate gas and blow out a cork. If a corked tube must be used, the cork should be fastened in place with adhesive tape. A tube and paddle may be given to a patient who has been carefully instructed in how to collect his own stool specimen.

(4) *Blood smear examination.* The technique for preparing a blood smear is described in paragraph 457*o*. The dried

microscope slides (always make two of them) are placed face to face with a bit of matchstick between them to prevent rubbing. Two copies of the hematology form are wrapped about the slides and fastened. The packet is then sent to the laboratory.

(5) *Urethral smear examination.* A urethral smear is prepared on a microscope slide. The head of the penis is cleaned by the patient with a bit of gauze wet with water. Then he is directed to milk his urethra. The slide is touched to the tip of the penis. The material thus taken is spread on the slide by a small stick or other nonabsorbent object. The slide is sent to the laboratory with two copies of the form for miscellaneous test or examination.

(6) *Blood for serology.* The technique for drawing blood for serological or chemical analysis is described in paragraph 457*b*. After the blood has been drawn, the tube is stoppered and allowed to stand until a clot has formed. It is sent to the laboratory with two copies of the serology request form.

(7) *Blood chemistry.* Various chemical tests of blood may be requested by the dispensary surgeon. Venous blood is drawn in the usual manner, the amount required depending on the type and number of tests performed. Some of these tests use serum, others whole blood. If the serum is to be analyzed, the blood is allowed to clot in the container. If whole blood is to be used in the test, an anticoagulant such as heparin or potassium oxalate must be used to keep the blood from clotting. The blood is sent to the laboratory with two copies of the blood chemistry request form.

(8) *Culture examination.* The technique for taking cultures is described in paragraph 458*b*. Material for culture is forwarded to the laboratory with two copies of the request form for miscellaneous test or examination.

c. Filing of Diagnostic Reports. An entry is made on the patient's Chronological Record of Medical Care of any X-ray or laboratory reports when the results may be of future value. These reports are filed in separate outpatient folders.

CHAPTER 7

RECOGNITION OF SYMPTOMS

Section I. INTRODUCTION

290. Signs and Symptoms

a. Signs and symptoms are defined in paragraph 400.

b. General instructions on observation of signs and symptoms are given in paragraphs 401–403.

291. References

a. Medical Terminology. See appendix II for construction of medical terms used in symptom recognition.

b. Anatomical Terms. See section I, chapter 3, for definition of terms used to describe surface anatomy of the body and surgical areas of the abdomen.

Section II. SYMPTOMS OF SKIN DISEASE

292. Common Symptoms of Skin Disease

a. Itching. The most common symptom in skin conditions is itching, or pruritus. Itching may be generalized or localized. Among the causes of generalized itching are allergies, dryness of the skin, pregnancy, diabetes, liver disease, leukemia (cancer of the blood), and internal malignant tumors. Among the causes of localized itching are infectious agents, scabies, infestation by lice, and pinworm infestation.

b. Rash. A rash is a temporary eruption on the skin. It may be generalized or localized. Common conditions that may cause a generalized rash include measles, chicken pox, allergic reactions, drug reactions, and syphilis. Localized rashes may be caused by bacteria, fungi, contact allergens such as poison ivy, and body parasites.

c. Edema. Edema is an excessive collection of watery fluid within the tissues. It results from disturbance of factors that normally regulate the exchange of fluid between blood in the capillaries and lymph (tissue fluid). Signs of some common forms of edema are hives, puffiness of the eyelids and cheeks, or a swelling of feet and ankles that retains an imprint when pressed. Edema often is localized at an area of injury or infection, such as a wound or burn. Generalized edema, however, is a frequent sign of some serious disorder such as kidney disease or heart failure.

d. Discoloration. Discolorations are frequently seen. Examples are pigmentation such as in moles or birthmarks, redness about areas of infection, loss of pigment as in vitiligo, and multiple discolorations in areas of bruising. Generalized discolorations may indicate serious disease. Cyanosis (blueness of the skin) usually indicates lack of oxygen in the blood. Cherry red skin may indicate carbon monoxide poisoning. Jaundice, or yellow skin and eyes, is a sign of diseases of the liver or bile ducts, or of hemolytic anemia. Pale skin and mucous membranes are other signs of anemia.

e. Masses. Common masses in the skin are sebaceous or epidermal cysts, moles, and neurofibromas. Large heavy scars called *keloids* are frequently seen in colored races. Primary and secondary malignant tumors are not infrequently found in the skin. Common masses under the skin include fibromas and lipomas (par. 301).

f. Ulceration. Ulcers or open sores of the skin may be due to injury, infection, poor circulation, or cancer. Any sore that fails to heal in a reasonable length of time should be suspected of being cancer.

293. Common Infections of the Skin

Common infections of the skin include infections by bacteria, infections by fungi, and infestations by parasites.

294. Bacterial Infections of the Skin

a. Furuncle. A furuncle, also commonly known as a boil, is an acute inflammatory lesion produced by staphylococcic infection of a hair follicle or a sebaceous gland (fig. 105). The lesion begins as a pustule (a blister containing pus). As the pustule enlarges, the skin becomes reddened, tense, and shiny. Usually the furuncle comes to a head rapidly and ruptures spontaneously, discharging pus. Furuncles may be single or multiple but tend to occur in crops. They may occur anywhere on the skin, particularly on the extremities, buttocks, back of the neck, axillae, and face. Furuncles on or about the nose, upper lip, or beneath the eyes may endanger life by extension along the veins of the face which drain into the venous sinuses of the brain. This is the "danger area" of the face (fig. 106).

b. Carbuncle. A carbuncle (fig. 105) resembles a furuncle because it has the same cause and early course; but a carbuncle is larger, flatter, and more painful than a furuncle and produces fever and leukocytosis. A carbuncle consists of several abscess pockets under the skin that connect to form a large abscess which drains onto the skin. When it ruptures, pus is discharged through several openings in the skin.

c. Impetigo. Impetigo (fig. 105) is a superficial, sometimes contagious, infection of the skin which most often affects the face. Sometimes it spreads to the hands and other exposed areas. The

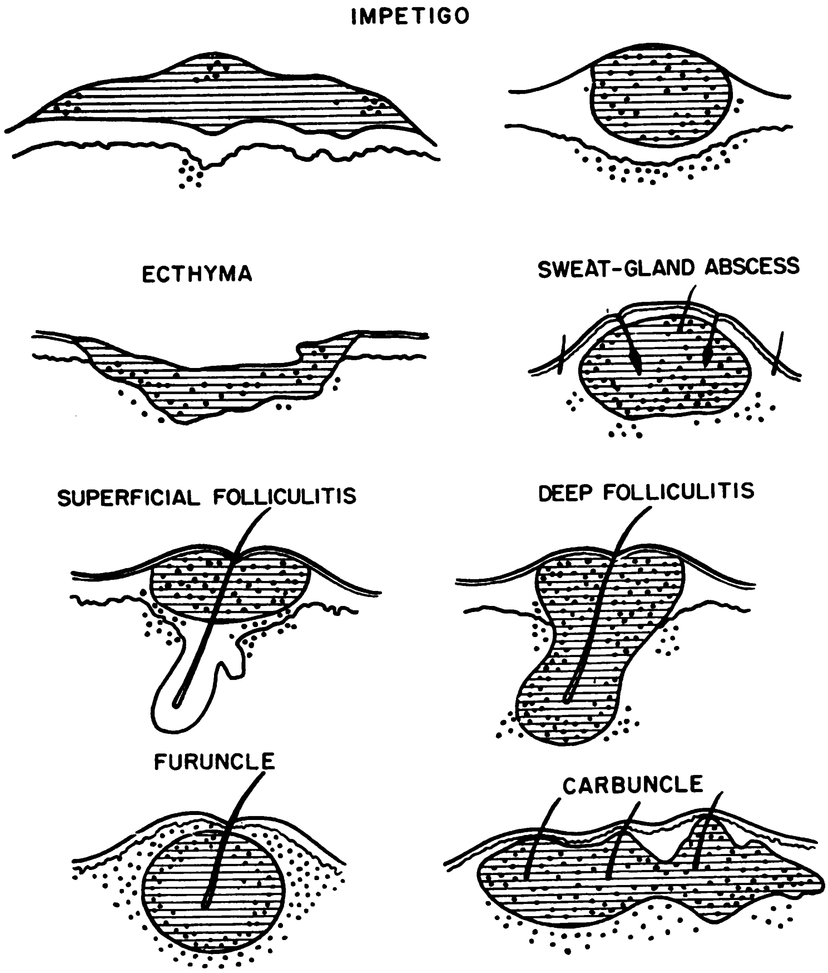


Figure 105. Infections of the skin (shaded areas indicate pus).

organisms causing the infection are staphylococci and streptococci. Impetigo begins as lesions on the skin. Later the lesions become crusted with material containing pus. Impetigo is more contagious among children than adults. It is spread by direct contact with discharges from the affected skin areas or by contact with articles soiled by discharges. In addition, it may be spread from one part of the body to another through scratching.

d. Cellulitis. Cellulitis is an acute, spreading inflammation of the skin and subcutaneous tissues caused by streptococci. The skin becomes red, tender, and swollen. The patient has fever. The infection may spread through lymph vessels, producing red streaks on the skin. It may enter the bloodstream and be carried throughout the body (septicemia or blood poisoning).

e. Folliculitis. Folliculitis (fig. 105) is an infection of hair follicles. Pustules form around the follicles, most often on the face. The lesions may be single or grouped, and if on the face, often ap-

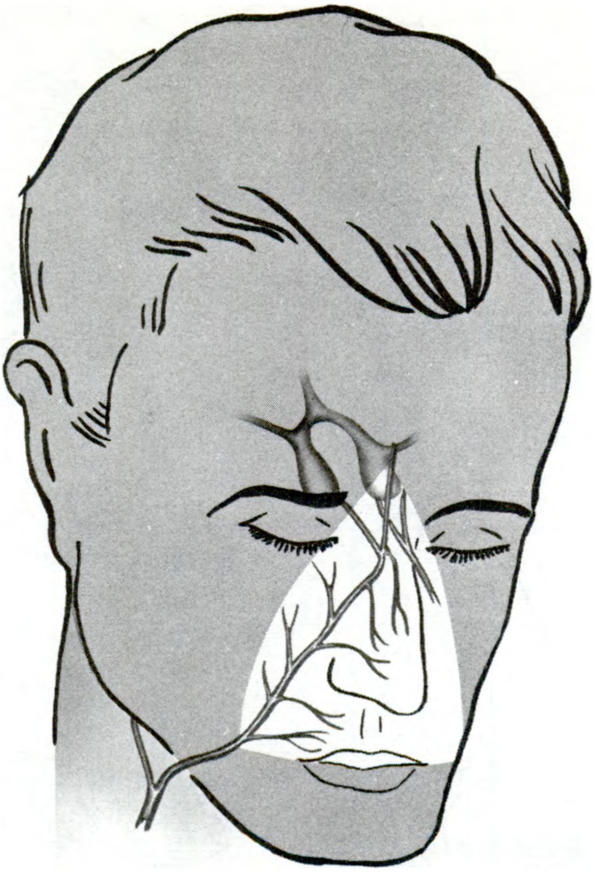


Figure 106. Danger area of the face.

pear first about the upper lip. Folliculitis is found most among persons who work with grease, oil, tar, or irritating chemicals.

295. Fungus Infections of the Skin

Fungi cause many infections of the skin. The most common types are athlete's foot and jock itch. Fungus infections which are circular in shape are called *ringworm.*

a. Athlete's Foot (Tinea Pedis). This is a skin eruption involving the feet and the skin beneath and between the toes. Other areas of the foot may be involved. In the acute stage of athlete's foot, there are shallow cracks between and beneath the toes. Tiny blisters or clusters of blisters occur along the sides and under the surface of the toes. In the chronic stage, blisters are replaced by scaling, reddened patches. The skin may become thick and fissures (small cracks) may develop.

b. Jock Itch (Tinea Cruris). Jock itch involves the inner surface of the thighs, inguinal folds, and occasionally the scrotum and buttocks. It forms an area of redness which may be weeping or scaling and is outlined by a border which is raised and shows small blisters.

296. Infestations by Parasites

a. Pediculosis. Pediculosis is infestation by lice. The symptoms are intense, persistent itching of the pubic area, the axillae, or the scalp; presence of nits (eggs) on hair; and presence of the louse. Irritation of the skin usually can be seen in the affected area. Three types of lice are parasitic on human beings:

(1) The pubic louse (crab) usually lives in the hair of the pubic region but may be found in the hair of other parts of the body. It lays its eggs as nits on the shafts of the hairs where it lives.

(2) The body louse lives and lays its eggs in the seams of clothing but it feeds on the body. Its tiny bite marks can be found on the shoulders, between the shoulders, or about the waist.

(3) The head louse lives on the scalp and lays its eggs on the shafts of the hair.

b. Scabies (Itch). Scabies is infestation of the skin by the itch mite. The mite burrows into the skin, causing a rash which occurs in patches and is accompanied by itching. The itching becomes more intense at night. The early lesion is a small burrow with a tiny blister at the end. The lesions are usually surrounded by scratch marks with excoriation and sometimes infection as the result of the scratching. Lesions are found particularly between the fingers, on the wrists, about the waist or armpits, or on the genitals and buttocks.

Section III. SYMPTOMS ARISING IN THE HEAD AND NECK

297. Headache

a. Tension headache. This is a dull, steady aching, usually felt at the back of the head and neck but sometimes frontal or general. This ache is caused by prolonged tension of the scalp and neck muscles often due to worry or strain. Although tension headaches usually respond to two aspirins and a good night's rest, some people are only relieved after discussion of their work or social problems.

b. Migraine Headache. This is a throbbing headache almost always occurring on only one side of the head. Just before the headache the patient will often develop an "aura." This aura may appear as flashes of light, spots before the eyes, twitching, nausea, etc. The aura varies with different patients but a person has the

same sensation before each attack and learns to recognize it. Migraine is also associated with nausea and vomiting.

c. Headache Due to High Intracranial Pressure. This kind of headache is especially severe. It may awaken the patient at night and is commonly associated with projectile vomiting. This is spontaneous vomiting without preceding nausea. The patient may feel well at one minute and then without warning spew vomitus across the room. These headaches often grow progressively more severe as days go by. They can be caused by a tumor, a blood clot, an abscess, meningitis, or any other condition associated with increasing pressure inside the cranium.

298. Neck Pain

Stiff neck is the commonest form of neck pain. It is a muscle spasm, usually following exposure to a draft. Patients with an ordinary stiff neck do not have fever. The patient who has fever should be asked to touch his chin to his chest. If he cannot do that, he should be suspected of having meningitis.

299. Fainting

See paragraph 207.

300. Convulsion

a. Description. A generalized convulsion or fit ordinarily begins with a sudden lapse of consciousness and a fall to the ground. The whole musculature is seized in a violent spasm. The contraction of the diaphragm produces a characteristic cry. The eyes turn up or to one side. The face is contorted. The jaw is set, often with biting of the tongue and oozing of saliva or blood from the mouth. The limbs may assume one of several positions. With continued spasm of the respiratory muscles, breathing is impossible and the color of the mucous membranes and the skin becomes cyanotic. After about 30 seconds, the rigid (tonic) state of the muscles gives way to a series of clonic (jerking) movements. Air enters the lungs in short convulsive gasps. The arms, legs and head jerk violently. After a minute or two, the movements become slower, then irregular, and finally stop. Then the patient lies relaxed, breathing deeply, and sweating profusely. Involuntary evacuation of the bladder and the bowels may occur. Now the patient may be apparently semicomatose and very difficult to arouse even by painful stimulation. A few minutes later the patient ordinarily stirs, may open his eyes and yet may remain confused, disoriented and difficult to engage in conversation for 20 to 30 minutes.

b. Causes. High fever is a common cause of convulsion in infants; epilepsy (par. 194) a common cause in children and young adults. In a mature adult who has his first convulsion, a brain tumor may be

suspected as the cause. Convulsions can also be caused by toxic agents such as insecticides, rat poisons, or toxic fumes.

301. Common Tumors of the Head and Neck

a. Sebaceous Cyst. A sebaceous cyst or wen is a soft, subcutaneous tumor formed by obstruction of the duct of a sebaceous gland. Sebaceous cysts may be as small as a pea or they may get to be as large as an orange. They may occur any place on the body where there are sebaceous glands. The scalp and the neck are among the areas most often involved. A sebaceous cyst forms a dimple in the skin when the mass is moved.

b. Lipoma. A lipoma is a subcutaneous tumor of fatty tissue. It is not attached to the skin. Lipomas are made up of lobes and the lobes are usually inclosed in a capsule. The forehead is a common site of lipomas.

302. Masses in the Neck

Enlarged lymph nodes at the angle of the jaw are commonly found in adults. Enlargement of lymph nodes elsewhere in this region usually indicates pharyngitis (sore throat) but it may be a sign of abscessed tooth, tuberculosis, leukemia, Hodgkin's disease, or a tumor of the head or neck with spread to the lymph glands.

303. Baldness (Alopecia)

Baldness is of two main types, primary or hereditary, and secondary.

a. Primary baldness occurs in persons who are born with a predisposition to baldness. It is characterized by loss of hair in an even or symmetrical pattern.

b. Secondary baldness may follow high fever or it may be caused by such things as ringworm, arsenic poisoning, endocrine disorders, or excessive irradition. Secondary baldness can be recognized by the loss of hair in sharply outlined round patches. The scalp may be reddened, also.

304. Dandruff

Dandruff is a material that forms on the scalp and comes off in small white or gray scales. There are two types of dandruff, primary and secondary. Primary dandruff is formed by the natural process of flaking off and replacement of dead scales of the skin and the scalp. Persons with primary dandruff show no redness or inflammation of the scalp. Secondary dandruff is usually due to a seborrheic dermatitis, an inflammatory disease of the skin of the scalp. In this condition, the scalp and forehead are usually reddened and oily.

305. Pimples

Pimples are small superficial infections in the skin, occurring most commonly among adolescents. Cleanliness is very important in treatment of pimples. Most pimples can be arrested by frequent washing of the face with a soap containing hexachlorophene and by dietary restriction of such things as sweets, nuts, fried foods, and fatty foods. Anxiety may be noticeable in some persons who have pimples. They should be encouraged to accept the condition and not withdraw from daily association with other persons.

Section IV. SYMPTOMS OF COMMON DISEASES OF THE EYE

306. Poor vision

The following conditions, any of which may cause poor vision, require evaluation by a physician.

a. Pterygium. A pterygium is a thickening of the conjunctiva that starts laterally and grows over the cornea. This thickening is caused by the irritation of wind and weather. It is common in farmers and sailors. A pterygium is easily removed by an ophthalmologist (physician who specializes in disases of the eye).

b. Cataract. A cataract is an opacity of the lens or of its capsule. An opacity is something which does not allow light to pass. Cataracts are generally due to heredity but they may be caused by metabolic diseases such as diabetes.

c. Retinal Detachment. A retinal detachment should be suspected in any person who has been close to an explosion, who has suffered a head injury, or who has had a blow to the eye, and then starts complaining of poor vision.

d. Refractive Errors. These are conditions where the light rays do not focus exactly on the retina. There are three errors of refraction.

(1) *Astigmatism.* This is a blurring of vision due to irregularity of the cornea.

(2) *Nearsightedness.* A person with this refractive error can see objects clearly when they are close but not when they are far away. Nearsightedness is caused by lengthening of the eyeball so that the image is focused in front of the retina.

(3) *Farsightedness.* This condition is the opposite of nearsightedness. The eye ball is too short and the image is focused behind the retina.

307. Swelling of the Eyelids

Swelling of the eyelids may be caused by kidney disease, blepharitis, hordeolum, or chalazion.

a. Kidney Disease. This condition should be suspected in any patient who says that recently he has noticed his eyes, and perhaps his hands, being puffy when he gets up in the morning.

b. Blepharitis. This is a low-grade inflammation of the margins of the eyelids. The margins are reddened and crusted.

c. Hordeolum (Stye). A stye is a pimple on the edge of an eyelid. Styes often are associated with eyestrain, poor general health, or infection elsewhere in the body.

d. Chalazion. A chalazoin is a small mass, similar to a sebaceous cyst, which can be felt on the upper eyelid. It is due to blockage of the duct of one of the lubricating glands on the under surface of the eyelid.

308. Inflamed or Reddened Eyes

Inflamed or reddened eyes can be caused by either of the following conditions.

a. Conjunctivitis. This is inflammation of the conjunctiva. The redness is found on the front of the eyeball and on the under surface of the eyelids. Conjunctivitis is caused by the common cold, hay fever or other allergies, irritation, and infection. Conjunctivitis due to infection is called purulent (pus) conjunctivitis or "pink eye." In purulent conjunctivitis there are associated symptoms of burning of the eyes, drainage of pus, and eyelids stuck closed in the morning.

b. Circumcorneal Redness. Here, in contrast to conjunctivitis, the redness is found around the cornea in linear streaks radiating outward. This is a sign of serious eye disease. The patient should be referred to a physician as soon as possible.

309. Foreign Bodies in the Eye

This is the most common complaint about the eye. A foreign body in the eye should be removed as described in paragraph 239.

Section V. SYMPTOMS OF DISEASES OF THE EAR, NOSE, AND THROAT

310. Symptoms Arising in the Ear

Symptoms arising in the ear include loss of hearing, earache, discharging ear, and ringing in the ear.

311. Loss of Hearing

Hearing loss is of two main types, conduction deafness and nerve deafness.

a. Conduction Deafness. This occurs when there is an impairment of the conduction of sound impulses to the inner ear. Conduction deafness is commonly caused by obstruction of the ear canal by a foreign body such as impacted ear wax (cerumen), a bean, or an in-

sect. A foreign body in the ear is easily detected by examination with the otoscope. With the exception of beans or other objects that swell on contact with water, foreign bodies can be irrigated out of the ear (par. 237). Conduction deafness is caused also by otitis media (par. 312) and aerotitis media. The latter is commonly seen in persons who have flown, while having an upper respiratory infection, in an aircraft without a pressurized cabin. Aerotitis media is due to closure of the Eustachian tube by inflammation. Normally the tube equalizes pressure of the outer atmosphere with the pressure in the middle ear. When pressure cannot be equalized, severe damage to the middle ear may result.

b. Nerve Deafness. This type of deafness may be seen following diphtheria, mumps, influenza, poliomyelitis or other disease which injures the auditory nerve.

312. Earache

Two common causes of earache are otitis externa and otitis media. Otitis externa is an infection of the ear canal. It is diagnosed by an increase in pain when the ear lobe is pulled and by otoscopic examination. Otitis media is inflammation of the middle ear often associated with obstruction of the Eustachian tube. It is accompanied by pain, frequently severe, and by some loss of hearing.

313. Discharging Ear

Discharge from the ear may be caused by otitis externa (par. 312), otitis media (par. 312), or basal skull fracture (par. 180*a*). A basal skull fracture should be suspected in any person who has a history of a head injury followed by discharge of a clear or a blood-tinged fluid from the ear.

314. Ringing in the Ear
(Tinnitus)

Ringing in the ear is a nonspecific symptom seen with many diseases and injuries of the ear. It is of little aid in diagnosis of ear disease.

315. Nosebleed
(Epistaxis)

Nosebleed is caused by injury, often mild, to the nasal lining. The bleeding point is usually found on the nasal septum close to the outer nostril. Bleeding usually can be controlled by pressure over the corresponding outer nostril. Nasal obstruction and discharge are commonly see in colds and allergies. In most cases, colds and allergies can be differentiated by examination of the lining of the nose. In colds the lining is reddened. In allergies the lining is pale.

316. Symptoms Arising in the Throat

a. Sore Throat. Sore throat generally is due to pharyngitis (inflammation of the throat) or to tonsillitis (inflammation of the tonsils). Many bacteria and viruses cause sore throat. Antibiotics should not be used indiscriminately in the treatment of these infections.

b. Hoarseness. Hoarseness may be caused by voice strain, viral infection of the larynx (laryngitis), or cancer. Usually it can be treated by resting the voice. Hoarseness that persists beyond seven days should be thoroughly investigated by a medical officer.

Section VI. SYMPTOMS ARISING IN THE CHEST

317. Cough

Cough is a common symptom but not always a prominent one. For example, a patient with pneumonia may be so distressed with pleuritic pain, headache, and fever that he does not complain of cough. There are, however, some common diseases (table VII) in which cough is usually the outstanding symptom for which the patient seeks treatment.

a. Types. Coughs may be classified as productive or nonproductive and as acute or chronic. A productive cough is one in which sputum is coughed up from the respiratory tract. A nonproductive cough is a dry cough. Sputum may be mucoid (clear), purulent (pus-containing), or bloody.

b. Causes. Some common causes of coughs are given in table VII. Any cough which persists beyond seven days deserves evaluation by a medical officer.

Table VII. Common Causes of Coughs

Disease	Productive cough	Nonproductive cough	Type of sputum	Associated symptoms
Pneumonia (Bacterial).	Yes		Purulent to blood-streaked.*	Fever, chills, pleuritic pain.
Bronchitis (Acute).	After 1–2 days.	At first	Clear	Burning under sternum.
Bronchitis (Chronic).	Yes		Clear to purulent.	Worse in morning.
Tuberculosis	Yes		Clear to gross bleeding.	Weakness, weight loss.
Cancer	Yes	Early	Clear to bloody	Weight loss, chest pain.

*Sputum may become streaked with blood after hard bouts of coughing from any cause.

318. Dyspnea

a. General. Dyspnea means difficult breathing. Shortness of breath is a common complaint of patients with disease of the heart or lungs. Occasionally, dyspnea is a symptom of tension or anxiety where no organic disease of significance is present.

b. Causes.

(1) Strenuous physical exercise.

(2) Diseases of the respiratory system. Blocked airway, pneumonia, collapse of lung, and such chronic diseases as tuberculosis, cancer of the lung, fungus infections of the lungs, or asthma can cause dyspnea.

(3) Heart failure. Certain diseases of the heart interfere with the function of the heart so that it cannot circulate the blood efficiently. When this happens, blood may be dammed up in the lungs so that exchange of oxygen and carbon dioxide between the blood and lungs is slowed. Sometimes patients with heart failure are comfortable at rest, but become short of breath when they move around (dyspnea on exertion). With exercise the body needs more oxygen but the heart is too weak to respond.

(4) Anxiety. Persons who are nervous, tense, worried or anxious may sometimes feel short of breath. They may overbreathe to the extent that they tingle in the fingers, feel lightheaded, or even faint.

319. Chest Pain

a. Pain in Chest Wall. Pain in the chest may be due to disease or to injury of the skin, muscles, ribs, or cartilages. Pressure over the area will usually reproduce or aggravate the pain. Such pain will disappear as the condition heals.

b. Pain in the Chest from Internal Sources.

(1) *Heartburn.* This is a deep, burning pain behind the sternum, often occurring after eating. Heartburn may be due to irritation of the esophagus or of the stomach by acid gastric juice. This pain can often be relieved by baking soda.

(2) *Pleurisy.* Pain arising from irritation of the pleura (the membrane covering the lungs) is often sharp and stabbing. It is made worse by breathing and is lessened by holding the breath. Pleurisy is a common symptom of pneumonia and tuberculosis. Sometimes a milder type of pleurisy occurs when a lung collapses.

(3) *Heart.* Pain originating in the heart is usually due to reduced blood supply to the heart. This pain is usually felt as a severe pressure behind the sternum, sometimes radiating

into the left shoulder, arm, or neck. Often it is accompanied by a feeling of suffocation and a sense of impending doom. When this pain comes and goes, it is known as *angina pectoris*. When the pain comes suddenly and persists and is associated with collapse of the patient, it is due to a myocardial infarction, commonly known as a heart attack.

c. Pain Originating in the Nervous System. Sometimes diseases or injuries of the nerves, nerve roots, or spinal cord may cause chest pain. The most common of these diseases are neuritis and herpes zoster.

Section VII. SYMPTOMS ARISING IN THE ABDOMEN

320. Nonspecific Symptoms

a. Anorexia, nausea, and vomiting are nonspecific symptoms of abdominal disease. Anorexia is loss of the appetite for food. Nausea is a sick feeling in the stomach often followed by vomiting. Vomiting is the forcible expulsion of the stomach contents through the mouth.

b. The above symptoms are found in almost all intra-abdominal diseases and in many generalized diseases of the body. However, absence of these symptoms does not mean that serious intra-abdominal disease is not present.

321. Jaundice

Jaundice means yellow. In medicine the term is used to mean a condition characterized by yellowness of the skin and sclera of the eyes. Jaundice is due to an excess of bile (fluid secreted by the liver) in the blood and tissues. The most common cause of jaundice in Army personnel is infectious hepatitis, a viral inflammation of the liver. The common clinical picture of infectious hepatitis is a person who loses his appetite for food and cigarets, is nauseated, and vomits. Besides these symptoms, the patient may be jaundiced and may have right upper quadrant abdominal pain and tenderness, dark urine, and light-colored stools. Such a patient requires hospitalization. Jaundice also occurs in obstruction of the bile ducts, in certain types of anemia, and in malignant disease of the liver. Any person with jaundice should be carefully studied by a medical officer.

322. Diarrhea

This symptom means a person is having frequent, loose bowel movements. Diarrhea generally is due to some irritation in the gastrointestinal tract. The most common cause of diarrhea in Army

personnel is viral gastroenteritis, a self-limiting disease lasting 2 to 3 days.

323. Constipation

Constipation is the inability to move one's bowels.

a. The usual cause of chronic constipation is improper bowel habits. The urge to defecate comes from a distended rectum. If a person ignores this urge for a time, distention of the rectum may fail to create the urge. In this case, the patient has to be re-educated to move his bowels at the same time each day, preferably after breakfast.

b. Other causes of constipation are lack of exercise, insufficient fluid intake or insufficient bulk in the diet, and habitual use of cathartics.

c. The acute onset of constipation in a person over 40 years old may mean serious disease. It should be evaluated by a physician.

324. Rectal Pain

Hemorrhoids are the most common cause of rectal pain. Hemorrhoids are dilations of veins beneath the membranes of the anus or lower rectum. Besides pain, the patient with hemorrhoids may notice drops of blood on toilet paper after bowel movements. This comes from hemorrhoids that have been torn by passage of stools.

325. Gastrointestinal Hemorrhage

a. Manifestations. Two manifestations of gastrointestinal hemorrhage are hematemesis and melena.

(1) Hematemesis is the vomiting of blood. This usually means that bleeding is occurring in the esophagus, the stomach, or the duodenum. The vomited blood may be red and clotted, but may also be dark brown (coffee-ground vomitus), due to the action of stomach acid on the blood.

(2) Melena is the passing of blood by rectum. The higher the bleeding lesion is in the gastrointestinal tract, the darker is the blood that is passed. For example, a bleeding peptic ulcer of the duodenum passes black blood from the rectum.

b. Causes. The most common causes of gastrointestinal bleeding are peptic ulcer (par. 327*b*), varicose veins of the esophagus, acute gastritis, and cancer. Less common causes are ulcerative colitis and amebic dysentery.

c. Treatment. Bleeding from the gastrointestinal tract is a sign of a serious condition which must be brought to the immediate attention of the medical officer. The patient may die quickly of uncontrolled bleeding. He should be kept quiet and warm in the shock position, and intravenous dextran or normal saline should be started through a large needle until whole blood is available.

326. Abdominal Pain

a. General. Usually, pain arising from a solid organ, such as the liver, is a constant ache. Pain from a hollow organ, such as a loop of intestine distended by gas, is cramping. It is wise to question the patient about what makes the pain better and what makes it worse. Often cramping pain caused by gas is relieved by passing of the gas. The pain of peptic ulcer usually is relieved by the ingestion of food.

b. Sources of Pain. The location of a pain often provides a clue to its origin (table VIII).

Table VIII. Sources of Abdominal Pain

Location of pain	Organ involved
Substernal	Esophagus.
Left side of epigastrium (pit of stomach)	Stomach.
Epigastrium	Duodenum.
Navel	Jejunum and ileum.
Right lower quadrant of abdomen	Appendix.
Right upper quadrant of abdomen	Liver.

327. Common Abdominal Conditions

a. Hepatitis. See paragraph 321.

b. Peptic Ulcer. Peptic ulcer is a chronic sore found in the stomach, in the duodenum, or occasionally in the esophagus. It is usually caused by the action of acid on the linings of these organs. Common manifestations of peptic ulcer are:

(1) Typical pattern of burning epigastric pain 1 to 3 hours after eating, relieved by food or alkalis.

(2) Gastrointestinal bleeding.

(3) Sudden perforation of the ulcer with acute peritonitis.

(4) Chronic obstruction to passage of food beyond the ulcer.

c. Appendicitis. Inflammation of the appendix usually has symptoms of anorexia, nausea, vomiting, low-grade fever, and abdominal pain. The pain is located in the right lower quadrant of the abdomen. If you ask the patient where his pain is, he usually points with one finger to that area (point tenderness).

d. Peritonitis. This is inflammation of the peritoneum caused by rupture of or injury to the intestines. It is seen after a perforated peptic ulcer, ruptured appendix, or perforation of the abdomen. The signs of peritonitis are abdominal rigidity, tenderness, and rebound tenderness (a sensation of pain on release of pressure). A patient with symptoms of acute peritonitis may require an emergency operation. He never should be given food or water by mouth. Morphine should not be given to such a patient because it may mask important clinical signs.

Section VIII. SYMPTOMS ARISING IN THE MALE UROGENITAL SYSTEM

328. Nonspecific Symptoms

Dysuria, frequency, and urgency are seen with almost all inflammatory diseases of the urogenital system. Dysuria is painful urination. The term frequency is used here to mean frequent urination. Urgency refers to the feeling that urination must take place immediately.

329. Specific Symptoms

a. Pain. The location and character of pain in the urogenital system often give a clue to the disease present. See table IX.

b. Fever and Chills. Fever and chills generally are seen only with involvement of the kidneys. See table IX.

c. Hematuria. Hematuria means the presence of blood in the urine. If bleeding is massive it may require active emergency treatment. A thorough evaluation by a medical officer is always necessary to determine the source of bleeding.

d. Penile Lesions. The diagnosis of lesions on the penis depends on clinical evaluation and laboratory findings. A patient with penile lesions should be referred to a medical installation where the tests can be done. Such a condition should not be treated until a definite diagnosis has been made.

e. Urethral Discharge. There are many causes of urethral discharge but the most common cause is gonorrhea. See table IX.

330. Some Common Diseases of the Urogenital System

a. Urethritis. Inflammation of the urethra has the symptoms of dysuria, frequency, urgency, and urethral discharge. Urethritis may be caused by gonorrhea. Diagnosis of urethritis is made by

Table IX. Common Urogenital Diseases and Symptoms

Disease	Area of pain	Dysuria, urgency, frequency	Type of pain	Fever	Urethral discharge
Pyelonephritis.	Lumbar	Yes	Steady	Yes	No.
Kidney stone	Lumbar, radiating to groin.	Yes	Cramping	Yes	No.
Cystitis	Suprapubic	Yes	Burning	No	No.
Urethritis (usually gonorrhea).		Yes		No	Yes.
Mumps	Testicle		Steady	Yes	No.

laboratory tests. The patient should be referred to a medical installation where the tests can be done. He should not be treated before a laboratory diagnosis is made.

b. Cystitis. Cystitis is infection of the bladder. It has the symptoms of dysuria, frequency, and urgency. When cystitis is suspected, urine specimens should be collected for laboratory examination.

c. Pyelonephritis. This is infection of the kidney. See table IX. It has the symptoms of fever, chills, dysuria, frequency, and urgency. Urine specimens should be collected for laboratory examination when pyelonephritis is suspected.

Section IX. SYMPTOMS ARISING IN THE BACK AND THE EXTREMITIES

331. Backache

Pain of sudden onset in the lower back is most commonly caused by acute muscle strain due to improper lifting or otherwise overworking the back muscles. Acute back pain may also be caused by injury, kidney disease, prostatic disease or diabetes. Chronic back pain may be caused by such things as injury, arthritis, flatfeet, ruptured intervertebral disk. Emotional difficulty often causes or contributes to chronic low back pain. The pain of such a backache can be just as severe and just as real as the pain of organic disease or injury. The usual patient does not actually complain of any emotional upset. He centers his worries almost entirely upon his back and thus he may be relieved of having to worry about much else.

332. Joint Pain

Common causes of painful, swollen joints are injury, infection, and rheumatic fever. Rheumatic fever should be suspected when the pain involves several joints or moves from joint to joint. Rheumatic fever is seen in about three percent of patients two to three weeks after inadequate treatment for streptococcal pharyngitis. Transport patients with joint pain as litter cases with no supports under the joints.

333. Painful Feet

a. Pes Planus (Flat Feet). There are many types of flatfeet, most of which cause no particular symptoms. Proper diagnosis and treatment require X-rays and careful examination by a medical officer who understands the stresses on the bones and joints of the foot. Improper use of arch supports and other devices may make the symptoms worse.

b. Ingrowing Nails. This condition is limited almost entirely to the nail of the big toe. The affected nail is curved so that its mar-

gins press into the flesh at its sides. Occasionally the nail cuts the tissue and an infection occurs. If the ingrown nail is not infected, proper trimming of the nail is all that is needed. If the ingrown nail is infected, hot soaks should be used, followed by trimming of the nail.

334. Subungual Hematoma

This is an accumulation of blood beneath the fingernail or toenail. It is usually due to a crushing injury of the digit. The pressure of the blood beneath the nail is painful. Much relief can be given by creating a hole in the nail to drain out the blood.

335. Paronychia

Paronychia is an infection around a fingernail. It is caused by repeated mild injury. It occurs most in persons whose hands have excessive contact with water, soap, or grease. Paronychia can develop into a serious condition. It should always be treated by a medical officer.

CHAPTER 8

WARD MANAGEMENT

Section I. THE ARMY HOSPITAL

336. Function

A hospital is a medical treatment facility primarily intended to provide inpatient care. It is staffed and equipped to provide diagnostic and therapeutic services, as well as the necessary supporting services required to perform its assigned mission. A hospital may also discharge the functions of a dispensary. Persons eligible to receive medical care at Army treatment facilities are described in AR 40–108.

337. Organization

Organization and terminology vary according to the class of hospital. The organization of a class I hospital, as decribed below, gives a general idea of the various services usually found in an Army hospital. (For types of hospitals see AR 40–21; for organization see AR 40–22.)

a. Office of the Commanding Officer. This includes the commanding officer, deputy commanding officer (when authorized), executive officer, adjutant, and other personnel required to assist the commanding officer.

(1) *Commanding officer.* The commanding officer is a Medical Corps officer. He is charged with the command, organization, and management of the hospital. He is responsible for the professional care and services provided to the patients and for the safety and well being of the entire hospital command.

(2) *Deputy commanding officer.* The position of deputy commanding officer, when authorized by the Department of the Army, is filled by a Medical Corps officer. He assists the commanding officer as directed. In addition, he initiates action for the appointment of prescribed boards of medical officers and supervises their activities. He coordinates medical audit activities, controls length of patient stay, and coordinates professional matters such as research, training, and use of consultants.

(3) *Chief of professional services.* When a deputy commanding officer is not assigned, the commanding officer may appoint a senior Medical Corps officer to serve as chief of professional services. He assists the commanding officer in coordination of professional matters.

(4) *Executive officer.* The executive officer is a Medical Service Corps officer who serves as the principal advisor and assistant to the commanding officer regarding administrative matters. He is responsible for the coordination and supervision of all administrative elements and nonprofessional staff functions of the hospital.

(5) *Adjutant.* The adjutant is a Medical Service Corps officer who is responsible to the executive officer for office service and other related headquarters functions. These functions include security officer for classified material, records administration, operation of the medical library, and supervision of suspense files, message center, mail delivery and collection, and similar office services.

b. Methods Improvement Office. This office serves the commanding officer by making surveys and studies on organization, procedures, and methods. A Medical Service Corps officer is chief of the office. In class II installations this office is designated as the Comptroller Office.

c. Registrar Division. This division maintains clinical records of all patients, collects medical statistical data, prepares various medical reports, operates the admission and disposition office, and functions as the hospital treasurer. Chief of this division is a Medical Service Corps officer.

d. Troop Command. The Troop Command is headed by a Medical Service Corps officer and is responsible for command and administration of the detachments of enlisted duty personnel and patients, management of unit personnel and civilian personnel programs, direction of nonprofessional education and training, and operation of welfare and recreation facilities. In class II installations this command is designated as the Personnel Command.

e. Food Service Division. This division is responsible for feeding patients and authorized personnel. This includes the planning of menus, the preparation and serving of foods, and the requisitioning and storing of food items. The chief of the division usually is a dietitian who is an officer of the Army Medical Specialists Corps.

f. Supply and Service Division. This division procures, stores, and distributes supplies; maintains, and repairs medical equipment; and provides logistical services such as transportation, laundry, and communications. A Medical Service Corps officer is chief of the division.

g. Medical Service. The Medical Service provides diagnostic service, care, and treatment to all patients assigned or referred to it. The Medical Service is headed by a Medical Corps officer and normally consists of the following sections: general medicine, dermatology, cardiology, communicable disease, and gastroenterology.

h. Surgical Service. The Surgical Service provides diagnostic service, care, and treatment to all patients assigned or referred to it. This service is headed by a Medical Corps officer and normally consists of the following sections: general surgery, orthopedic, EENT (eye, ear, nose and throat), anesthesia and operative, urology, obstetric, and gynecology.

i. Neuropsychiatric Service. This service provides diagnostic service, care, and treatment to all patients with psychiatric disorders or neurologic disorders. The service is headed by a Medical Corps officer and normally consists of the following sections: neurology and psychiatry, consultations, clinical psychology, and psychiatric social work.

j. Nursing Service. The Nursing Service provides complete nursing care to patients assigned to the various clinical units of the hospital in accordance with policies and procedures prescribed by the hospital commander and responsible physicians. This service is made up of all military and civilian personnel used in the performance of its assigned functions. The Nursing Service is headed by a Nurse Corps officer, designated the Chief Nurse. She is assisted in administering the Nursing Service by nursing supervisors. It usually includes the following sections: medical nursing, surgical nursing, neuropsychiatric nursing, outpatient nursing, and Centralized Materiel Section. The purpose of the Centralized Materiel Section is to provide sterile supplies and emergency technical equipment to wards and clinics.

k. Outpatient Service. This service provides or arranges for the treatment of all patients requiring outpatient care. When the scope of the outpatient function does not warrant its operation as a separate service, it is established as a section of the Medical Service (*g* above). The Outpatient Service is headed by a Medical Corps officer and includes the outpatient clinic and all dispensaries operated by the hospital.

l. Radiological Service. This service provides the diagnostic and therapeutic radiological service required in the examination, care, and treatment of patients. Where the workload is small, this service may be operated as a section of the Medical or Surgical Service. It is headed by a Medical Corps officer.

m. Physical Medicine Service. Physical medicine is a special field of medicine that uses physical means in the diagnosis and treatment of disease. Physical medicine includes physical therapy, occupa-

tional therapy, and physical reconditioning. The Physical Medicine Service, headed by a Medical Corps officer, consists of three sections: consultation and diagnosis, physical therapy, and occupational therapy.

n. Laboratory Service. This service provides complete laboratory service for the hospital. It is headed by a Medical Corps officer and consists of two sections: anatomical pathology and clinical pathology.

o. Dental Service. The hospital Dental Service provides dental care for dental cases admitted to the hospital, other inpatients, outpatients referred to the hospital by the installation dental service, and personnel assigned to the hospital. A Dental Corps officer is chief of the service.

p. Pharmacy Service. This service operates the hospital pharmacies. It stores, compounds, and dispenses pharmaceutical items used by the hospital. The Chief of the Pharmacy Service is a registered pharmacist of the Medical Service Corps or, if such an officer is not available, an officer of the Medical Corps.

Section II. THE HOSPITAL WARD

338. General

A ward is a unit of a hospital. It is composed of a number of beds and other equipment needed for the care of the patients. Usually a ward is somewhat specialized for the care of certain types of illness such as surgical cases, heart diseases, infectious diseases, or mental illness. A ward is under the command of a Medical Corps officer and all personnel assigned to the ward as patients, or for the care of the patients, are under the command of this medical officer. The primary mission of a ward is the professional attendance, care, and treatment of patients. Such care and treatment, however, cannot be accomplished properly unless efficiency of administrative methods and unity of the patient care team are maintained.

339. Organization

a. Ward Officer. The ward officer is a medical officer (physician). This officer is in charge of the ward regardless of the rank of others who may be assigned to the ward. The ward officer is responsible to the chief of his service for the care and treatment of patients on the ward and for efficient operation of the ward.

b. Assistant Ward Officers. If available, medical officers may be assigned as assistant ward officers to perform such professional duties as the ward officer directs.

c. Head Nurse. The head nurse determines how the medical officer's orders are to be carried out. The head nurse is responsible to the ward officer and to the Chief, Nursing Service, for nursing care

of the patients, administration of the ward, and supervision and instruction of nursing service personnel.

d. Duty or Staff Nurse. The duty or staff nurse is responsible to medical officers for execution of medical orders and to the head nurse for the standard of nursing care given. The duty or staff nurse assist the head nurse in planning and carrying out nursing care, prepares and administers prescribed medications and treatments, and instructs and supervises enlisted personnel in their patient care duties.

e. Wardmaster. The wardmaster is the noncommissioned officer-in-charge. He is responsible to the head nurse or, if no nurse is assigned, to the ward officer, for the conduct of the enlisted duty personnel and patients.

(1) The wardmaster is responsible for the cleanliness and order of the ward. He plans cleaning details and supervises medical specialists and corpsmen in cleaning duties. He instructs and supervises the specialists and corpsmen in other work activities and in the routine care and treatment of patients.

(2) He estimates supply needs, and requisitions supplies.

(3) He assists the nurse or the medical officer in administering treatments. On wards to which nurses are not assigned, the wardmaster is responsible for the administration of prescribed medications and treatments, the keeping of records, and other similar duties that may be assigned to him by the ward officer.

(4) He performs other duties assigned by the head nurse or ward officer.

f. Medical Corpsmen and Medical Specialists. Medical corpsmen and medical specialists are responsible to the doctor, head nurse, and wardmaster. Medical specialists perform routine nursing care or assist in performing the more complicated technical nursing procedures. They also assist with cleaning details. Medical corpsmen assist with patient care and perform assigned cleaning details.

340. The Patient Care Team

The primary mission of an Army medical treatment facility is to care for its patients. To accomplish the mission the Army Medical Service employs the concept of the "patient care team" in the operation of its treatment facilities. The term "patient care team" refers to the group of individuals who work together in the care and treatment of patients. In a hospital ward this team includes all the personnel described in paragraph 339. The traditional leader of this team is the medical officer. He orders medications, makes decisions, and delegates responsibility to the other members of the team in order to accomplish the workload. Supervision of direct patient care is usually delegated to the head nurse of the ward. She interprets the

doctor's orders, delegates responsibility to nonprofessional personnel according to their skill level, and performs skills required of a professional nurse. The wardmaster is usually made responsible for matters pertaining to indirect patient care, such as ward sanitation, supply, and maintenance of equipment. He consults with the head nurse; both are responsible for teaching and helping others on the patient care team. The medical corpsman and medical specialist carry out the doctor's orders under the supervision of the nurse, report observations, and report effects of treatment. The roles of the medical corpsman and the medical specialist are essential ones. They see the patient more often than any other member of the team and share his day with him. Their relationship and care of the patient are an important part of total patient care and will significantly affect his progress.

341. Interpersonal Relationships of the Patient Care Team

a. Importance of Good Interpersonal Relationships. All members of the team have a responsibility for attaining good relationships with one another as well as with the patients. These good relationships are important for three reasons: (1) they are helpful to patient care; (2) they increase the job satisfaction among members of the team; and (3) they improve the team's personal relationships with patients.

b. Means of Developing Good Interpersonal Relationships. The hospital patient care team can develop good interpersonal relationships in the following ways:

(1) *Clear understanding of line of authority.* All members of the team should understand their responsibilities and authority. Every member should observe the prescribed organizational relationships both in accomplishing his own assignments and in assisting others.

(2) *Understanding the transitory status and pecularities of the patient.* This calls for realizing that the patient's stay in the hospital is limited and for accepting the patient as he is, and not as you want him to be. It is important that the patient be made to feel that he is "wanted." Hospitalization is an abnormal way of life for the patient and it often causes him to feel insecure and fearful. Hospital personnel must try to dispel this feeling of fear and strangeness in the patient. Orientation of the patient is essential. If he knows what to expect from the hospital and what the hospital expects of him, he will be less apt to become apprehensive, critical, or demanding.

(3) *Understanding emotional problems of the patient.* Sickness changes the behavior of many individuals, making them emotionally unstable, irritable, demanding, or unreasonable.

While only certain members of the hospital team can treat these problems, all members should be aware of them. Kindness, sympathy, and simple courtesy are effective tools for dealing with these problems.

(4) *Reference.* Interpersonal relationships in the care of patients are discussed in detail in DA Pam 8–13.

Section III. UTILIZATION OF PERSONNEL ON THE WARD

342. General

Good ward administration includes proper utilization of duty personnel assigned to the ward. It insures a systematic distribution of personnel so that the medical installation has a 24-hour coverage and it distributes the workload fairly according to the various levels of skills and knowledge of the members of the patient care team. Several "tools" are used to assist in this very important area of ward administration: the report, the daily assignment sheet, the patients' duty roster, and the time schedule.

343. The Report

A report is made by the personnel going off duty to those coming on duty. This is usually done during the half hour when the two shifts overlap. The report includes present ward census, conditions and progress of the patients during the preceding shift, and any observations or problems. At this meeting of representatives from both groups of duty personnel, the nurse or the noncommissioned officer in charge of the ward uses the Nurse's Book Unit, as this provides a method of systematically reporting patients' progress. After the personnel going off duty leave, the head nurse directs the personnel coming on duty to the daily assignment sheet.

344. The Daily Assignment Sheet

This sheet provides a method by which doctor's orders and nursing care instructions are interpreted by the nurse on a form for use by ward personnel. It is a means of distributing direct and indirect patient care assignments among the ward personnel. Direct patient care assignments are those assignments which have to do with care and treatment of the patient himself; indirect patient care assignments are for duties having to do with ward cleaning, checking supplies, etc. Direct patient care assignments are made by name of the patient (*a* below). Indirect patient care assignments are usually by job to be done; for example, "clean utility room" (*b* below).

a. Direct Patient Care Assignments. These assignments are made by the nurse. She distributes the workload according to the MOS, the experience, and the skill level of nonprofessional personnel. Daily and specially prescribed care of patients, medications, and

collection of specimens are some of the types of assignments given. Members of the team given these assignments must consult the *Patient Care Plan*, designed by the nurse to provide ward personnel information as to the specific needs of the patient. This plan insures continuity of patient care and treatment and provides information so that ward personnel can plan their time to the best advantage.

b. Indirect Patient Care Assignments. These assignments are also made by the nurse and coordinated with the wardmaster. They include such tasks as maintaining ward sanitation and caring for supplies and equipment. The workload is governed by the number of assigned duty personnel and the types and number of patients. Ambulatory patients under the supervision of duty personnel can assist in many of these tasks. Use of patients on a duty roster is explained in paragraph 345. Indirect patient care assignments are frequently made on a *Detail Roster*.

c. Considerations in Making Assignments. In making assignments the training and skill level of personnel must be considered first. Rotation of personnel on assignments considered difficult or undesirable and rotation of personnel to increase their skill level and knowledge are essential. Personal desires may be considered whenever possible.

345. Utilization of Patients for Indirect Patient Care

Before patients can be assigned duties on the ward, the doctor must give his approval for the particular type of task. When patients are used, they are assigned to indirect patient care duties and are always supervised by a member of the ward team. Preparation of the Patients' Duty Roster is usually the responsibility of the wardmaster, who coordinates with the nurse.

346. The Time Schedule

This is a method by which the nurse and wardmaster assign the working hours of ward personnel. Its purpose is to provide 24-hour coverage for the ward and a systematic distribution of personnel. Personnel are listed by name and rank in the first column; their days to work are indicated in the next column; and duty shifts are indicated by blocks. The nurse is responsible for the preparation of this schedule; at times she may delegate the responsibility of arranging the schedule for auxiliary personnel to the wardmaster. The schedule is usually made and posted one to two weeks in advance. The patient workload is considered first in making a time schedule. Training and skill are also given great consideration, as some shifts require personnel who can work under a minimum of supervision. Rotation on less desirable shifts is provided for. Personnel are also rotated to provide additional training and experience. Personal desires are considered whenever possible.

All shifts are provided for with consideration given to having adequate personnel on the ward to meet heavy and light workload days.

Section IV. WARD CLEANING

347. Importance of Cleanliness

The ward must be maintained as a safe and comfortable environment for the sick. Cleanliness is important for its psychological effect as well as for the prevention of disease and infection. The outlook of a sick person is even more likely to be influenced by his surroundings than that of a person in good health. Cleanliness and order of the ward and of the patient's unit will contribute to his mental health. Moreover, since dust particles carry microorganisms found in the air, a definite relationship exists between uncleanliness and certain types of disease. In a hospital where many people are living in a limited area and where virulent strains of bacteria are likely to be present, cleanliness is especially important.

348. Daily Cleaning of the Patient Unit

The patient unit on the ward must be cleaned each day while it is occupied by a patient and must receive a more thorough cleaning once a week and when the patient has been discharged. Clean the floors of the unit according to their composition. Varnished wood or rubber tile floors are usually damp-mopped with cold water. Dust the furniture with a damp cloth. Keep a basin of water at hand in which to rinse the dust cloth frequently. Remove dust with a firm stroke. Be sure to clean all the corners, moving the furniture to clean behind it. Obtain a clean drinking glass and place it on the bedside table. Make the bed and replace the paper bag. Remove from the unit the soiled linen, the paper bag of waste material, and all cleaning equipment. Aline the furniture.

349. Cleaning the Unit After the Patient Is Discharged

Check the bedside table for articles left by patient. Turn in to the wardmaster or the nurse anything you find. Place a chair at the foot of the bed. Remove the pillow and case. Place the pillow on the chair and the case in the hamper of soiled linen. Strip the bed, placing all soiled linen and blankets in a laundry hamper and the rubber sheet on the chair. Wash the rubber sheet on both sides and hang it to dry. Damp dust the mattress and turn it to the foot of the bed. Wash the bed, bed frame, and springs with warm soapy water or with the solution recommended by the hospital. Raise the head rest and clean under it. Be sure to remove any stains or marks. Turn the mattress to the top of the bed and complete the damp dusting. Dust the furniture, mop the floor, and remove all

trash and soiled linen. If possible, air the unit for 24 hours and then remake the bed, using clean linen.

Section V. WARD EQUIPMENT AND SUPPLIES

350. Sources

There are three principal sources of the equipment and supplies on the ward: Quartermaster, Medical Supply Service, and the Centralized Materiel Section (CMS). Such expendable items as toilet paper, soap, and thermometers are from Quartermaster; beds and bedside tables are from Medical Supply; oxygen tents, respirators (unsterile), and syringes and needles (sterile) are obtained from CMS. Supplies and equipment are requisitioned as needed in accordance with hospital procedure.

351. Economy

It is the responsibility of each member of the patient care team to use supplies economically and to exercise care in using equipment. Supplies and equipment should at all times be used only for the purpose for which they were intended. Use of good bed linen for cleaning rags, for example, is contrary to the principles of supply economy and the cost consciousness program.

352. Maintenance of Equipment

It is the responsibility of all duty personnel in a ward to report to the nurse or wardmaster if any part of any equipment is missing or is not working properly. Never attempt to make unauthorized repairs yourself. Trained personnel in the Medical Maintenance Section will repair all items on request. Always follow the directions for use of equipment and use it only for the purpose for which it was intended.

353. Property and Linen Exchange

When equipment is damaged, worn, or obsolete, it is exchanged for like equipment in good condition by turning it in to the issuing agency and receiving a replacement. Linen exchange is used in some hospitals, but many now have automatic linen issue, a procedure which saves personnel much time.

354. Care of Equipment in General

Equipment is usually cleaned, disinfected, and stored in the utility room (a work and storage place equipped with sinks, sterilizers, and shelves). In cleaning equipment, consider the material from which it is made, as different kinds of materials require different care.

a. Routine Cleaning. Rinse off blood, pus, or mucus with cold water first as these substances contain protein, which is hardened

by heat. Then wash the item in hot, soapy water, followed by a hot rinse. Dry it or hang it up to dry.

b. Cleaning Materials That Cannot be Put Into Water. Wipe these with a damp cloth wrung out of hot, soapy water or a disinfectant recommended by the hospital. Dry the item well with a soft cloth. Examples of such equipment are flashlights, blood pressure apparatus, and stethoscope.

355. Care of Special Items of Equipment

a. Corrosion-Resisting Steel or Metal. Use the routine cleaning procedure, as described in paragraph 354. Metal polish may be used to remove stains. Do not use gritty scouring powders, as they leave scratches. Acids corrode the metal. After cleaning these items, disinfect or sterilize them according to the standing operating procedure of the ward. Take care not to bang this equipment against something or drop it, as it dents rather easily.

b. Glassware. For cleaning glassware such as medicine glasses, syringes, etc., use the routine cleaning procedure (par. 354*a*) and disinfect or sterilize these articles after use, if necessary. As items made of glass chip, crack, or break easily, handle them with care to avoid hitting them against a hard surface. Never place a cold glass in very hot water or vice versa.

c. Rubber Goods. Hot water bottles, ice bags, rubber sheeting and other rubber goods must be rinsed well after routine cleaning, as soap deteriorates rubber. Dry them, or hang them to dry, and store them in a cool place. Avoid folding or bending these items when you store them. Inflate them with air, if necessary, to keep the sides from sticking together. Take care that they do not come into contact with heat, acid, or oil, as all these ruin rubber.

d. Instruments. Use routine cleaning procedure, and clean as soon as possible after use. Open hinged instruments so that all parts may be thoroughly cleaned. After rinsing them, dry thoroughly to prevent rusting. Instruments used on the ward are frequently sterilized in the Centralized Materiel Section, where they are exposed to moist heat under pressure (par. 426).

e. Linen. Keep clean linen in a locked room to safeguard it. Clean linen is obtained from linen supply. Soiled linen is sent to the hospital laundry. Torn linen should not be used; send it for repair. Never tear up sheets to make cloths for cleaning.

f. Plastic Articles. Plastic items such as oxygen tents, tubes, and inhalers cannot withstand high heat and, therefore, cannot be sterilized by heat. After cleaning according to the routine procedure, rinse them well to remove all soap. Check with the nurse as to the disinfecting or sterilizing solution to use.

Section VI. WARD AND PATIENT SAFETY

356. General

a. Safety means freedom from danger or hazard. Safety in a hospital is attained through accident prevention. This in turn calls for maintaining safeguards for patients, duty personnel, and visitors. The safety of the patient must always be considered in giving patient care. This involves providing a safe environment, practicing safe work methods, and using equipment properly. Accident prevention is a responsibility shared by all members of the patient care team.

b. The main causes of hospital accidents are negligence by the personnel, careless work habits, improper use of equipment, and use of faulty equipment. Most of these hazards can be avoided if all hospital personnel observe safety rules, practice safety measures, and recognize and eliminate, or report, hazards.

357. Safety of Environment

The following are ways to promote safety in the hospital environment.

a. Keep floors clean, dry, and free of objects which might cause a person to fall. When washing or polishing floors, take special precautions to guard against falls.

b. Keep corridors clear and well-lighted.

c. Keep working areas well-lighted.

d. Keep latrines lighted at night.

e. Keep casters and cranks of beds turned inward.

f. Discard used razor blades and knife blades in proper containers.

g. Keep poisons in locked cabinets. (Poisons are always specially labeled by the pharmacy before they are sent to the ward.)

h. Use proper body mechanics (par. 361) in moving and lifting objects.

i. Report unsafe conditions to the proper personnel.

358. Safety in Giving Patient Care

Safety in handling patients and in carrying out treatments is most important.

a. Take precautions to prevent patients from falling out of bed. Use bedrails, securely attached, on beds of young children, elderly patients, and patients who are restless or unconscious. Provide footstools and other assistance for patients having trouble getting into or out of bed. Keep the bedside table and call bell within easy reach of the patient. Warn him about the height and width of hospital beds. Lock the wheels of the patient's bed.

b. Provide adequate support in lifting patients. Always get someone to help you when moving or lifting a heavy or a helpless patient.

c. Take all necessary precautions when the patient is receiving oxygen. Do not smoke. Warn all other personnel against smoking. Post "No Smoking" signs. Do not use electrical appliances in the room. Use tap call bells instead of electric ones.

d. Test hot water bottles for temperature and leaks. Always cover the bottle.

e. Give constant supervision to patients receiving treatment with heat lamps.

359. Safety in the Use of Equipment

a. Know how to use and care for equipment properly. Read all directions in the operator's handbook or manual accompanying the equipment.

b. Take all necessary precautions when using electrical equipment. Examine the cords and the plugs of electrical appliances before using them. Arrange electrical cords so that there is no danger of anyone's tripping over them. Keep electrical equipment dry. Do not use faulty equipment; tag it and turn it in for repairs. Leave the repairing of equipment to personnel trained and authorized to do it. Always follow the rules in operating steam sterilizers. Cut off the steam supply before opening a sterilizer. Keep face and hands away from the opening area of the sterilizer.

360. Fire Prevention and Control

Practice fire prevention. Enforce smoking rules for patients. Use metal containers for waste. Never dim lights by covering them with a towel or with paper. Be careful when using flammable fluids such as ether. Keep closets free of combustible material. Store oil mops in a well-ventilated place. Discard oil cleaning cloths in metal containers. Report gas odors immediately. Know and obey fire regulations. Keep fire doors closed. Know the location and operation of fire extinguishers. Know the evacuation plan of the ward.

361. Body Mechanics

a. General. Body mechanics is the coordinated use of body parts to produce motion and to maintain balance. Body mechanics includes posture and the use of the body in moving and lifting. Body mechanics also is related to disease. Posture, or body alinement, affects the size and shape of body cavities, and this in turn affects the position of viscera. Posture also determines the distribution of weight and pull on the joints. Thus, it is desirable for ward personnel to know and to apply the principles of good body mechanics in going about their work, especially when moving, lifting, and positioning patients.

b. Principles.

(1) Use mechanical principles in lifting and moving objects.

(*a*) Move an object on a surface by pushing, pulling, rolling, or turning. This uses leverage and momentum to best advantage.

(*b*) Reduce friction when possible.

(2) Use the body with a minimum of strain.

(*a*) Keep the trunk and head in good alinement in preparation for lifting.

(*b*) Face the direction of movement. Avoid twisting when lifting.

(*c*) Bring the objects to be lifted, or carried, as close to the body as possible.

(*d*) Use a wide base of support. This gives better balance.

(*e*) Alternate between periods of activity and rest.

c. Importance. Use of good posture and good body mechanics is beneficial to both ward personnel and patients. For ward personnel, it conserves energy, reduces strain and fatigue, and improves appearance. For patients, it speeds maximum recovery and prevents disability and deformity.

Section VII. RECEPTION, TRANSFER, AND DISCHARGE PROCEDURES FOR WARD PATIENTS

362. Reception of a Patient on the Ward

The manner in which a patient is received in the hospital and on his own ward is an important contributing factor to his attitude and, therefore, toward his recovery. A feeling of confidence must first of all be established. Entering a hospital sometimes tends to stimulate a considerable amount of dread and apprehension in the patient. Admission procedures should be as brief and as reassuring as possible. Show interest in the patient as an individual, and make it apparent to him that his care is planned on an individual basis.

363. Assignment of a Patient to His Unit

When a patient enters an Army hospital and reports to his assigned ward, he will usually bring with him several forms which have been initiated in the Admission and Disposition Office. The head nurse will initiate his clinical record—a permanent history of his hospitalization and illness—and will assign him to his unit. She, as well as the specialist who assists him in his preparations for his hospitalization, will try to reassure him by their interest and attention. He must be oriented to the ward routines, to the hospital procedures, and to the use of the call system. Introduce him to the patients near him and to the duty personnel. Take his temperature, pulse, respiration, and blood pressure, and record them on his chart. Also enter on the chart his height and weight. Notification of his admission must be given to the ward officer, to the food service section, and (if

he is seriously ill) to the chaplain. Send an ambulatory patient as soon as feasible after his arrival to the laboratory and the radiology service for chest X-ray, blood work, and urinalysis; follow the doctor's orders for bed patients.

364. Safekeeping a Patient's Valuables

When a patient enters the hospital through the Admission and Disposition Office, he is asked to turn over to the Patient's Trust Fund any valuables or money he will not need while he is hospitalized. At this time, too, he is usually issued hospital clothing and allowed to turn in his own clothing for storage in the clothing room until he is discharged. If a patient enters the ward directly, the nurse calls the Patient's Trust Fund, which sends a representative to receive the valuables. Property of the patient is labeled and he is given a receipt for it. The patient should be encouraged to safeguard any possession of value in this way, so that he will not be concerned about his valuables during hospitalization. He should be reminded that the hospital is not responsible for articles lost on the ward.

365. Transfer of a Patient

a. A patient may be transferred from one ward to another in the hospital. For example, a surgical patient may be sent to a medical ward for medical treatment or a medical patient sent to a surgical ward preceding surgery. The transfer is always initiated by the doctor, who discusses the patient with the doctor on the ward that is to receive the patient. The doctor completes the patient's chart, informs the patient and nurse of the transfer, and writes an order for transfer on the doctor's order sheet. When he informs the patient of his transfer, he always explains to him the reason for it. The nurse notifies the ward receiving the patient and any section of the hospital which is immediately concerned with his care.

b. The corpsman assists the patient in assembling his belongings and checks to see that he takes along his "Property" and "Deposit" slips. The corpsman takes the bed card to the nurse and obtains the patient's records. The mode of transportation of the patient from one ward to another depends upon his condition. The corpsman takes the patient to the ward to which he is transferred, and carries with him the patient's records. He turns over these records to a responsible person and exchanges property for which his ward is responsible. The corpsman should show interest in the patient and reassure him as needed concerning questions about the new ward and delivery of mail. The corpsman is responsible for cleaning the patient's unit after the patient has been transferred.

366. Discharge of a Patient

a. All treatment and care of a patient from the time of his arrival in the hospital are directed toward his discharge. The type of dis-

charge depends upon the condition of the patient. Most patients are discharged to duty; but retired personnel, dependents, etc., are discharged to their homes. Military personnel, being retired for disability, must meet a board before their discharge, A few patients are sent to other hospitals for further treatment. The doctor, who is responsible for indicating the approximate date and the conditions under which a patient is to be discharged, completes the patient's chart and informs the nurse and the patient of the discharge. The nurse initiates discharge proceedings by sending the completed chart to the Registrar's Office and informs other sections of the hospital (such as the diet kitchen) that are concerned with the patient's discharge. She gives the patient instructions concerning procedure for clearance and any followup appointment, diet, medication, treatment, etc., he must remember following his discharge.

b. The corpsman is responsible for assisting the patient to assemble his belongings such as clothing from the clothing room, valuables from the Patient Trust Fund Office, and all articles from his bedside cabinet. The corpsman then directs the patient to the disposition office, removes the bed card, and cleans the patient unit.

367. Care of the Deceased and Administrative Procedures Following Death

a. General. The procedure for care of the dead varies from one hospital to another. In general, however, follow the steps explained below if you are asked to prepare the body of the deceased.

b. Administrative Procedures. Notify the ward officer, ward nurse, or medical officer of the day if the patient apparently ceases to breathe. *Do not touch* the body until the medical officer has made his examination and pronounced the patient dead. Screen the patient from the view of the other patients if this has not been done previously. Use tact and sympathy with the patient's family if they are present. Notify the chaplain, the registrar, (or the administrative officer on duty after duty hours). Notify the nursing office. All possessions of the patient are carefully inventoried by an officer in the presence of a witness. If the next of kin is present, the valuables are turned over to him; otherwise, the patient's clothing is sent to the clothing room and his valuables to the registrar. A death certificate and three death tags are signed by the medical officer. All records are completed and sent to the administrative officer of the day. One copy of the clinical record will accompany the remains to the morgue.

c. Procedure for Care of the Body of the Deceased. Procedures for care of the body of the deceased vary from one hospital to another. Follow the standing operating procedure of the installation in which you are working.

CHAPTER 9

BASIC NURSING CARE OF THE PATIENT IN THE HOSPITAL

Section I. THE PRINCIPLES OF GOOD NURSING CARE

368. The Meaning of Good Nursing Care

Nursing care means more than the performance of the manual activities involved in the care of the sick and injured. It includes care of the mind and spirit in addition to care of the body. In its broadest sense, nursing care means "total patient care."

369. The Objectives of Nursing Care

The principal objective of nursing care is to restore the patient to health. Everything that is done on the ward is either directly or indirectly concerned with accomplishing this goal. It can be accomplished best by careful attention to all phases of "total patient care." Besides patient hygiene and the administration of diagnostic and therapeutic measures as prescribed by the doctor, total patient care includes various measures which add to the patient's well-being. Some of these measures are (1) treating the patient as an individual, (2) providing clean equipment in good working order for the patient's use, (3) providing for the patient's rest and relaxation, (4) providing clean and attractive surroundings, and (5) keeping the patient unit quiet and cheerful.

370. Role of the Specialist in Good Nursing Care

Medical specialists and other enlisted personnel of the ward have an essential role in the care of the patient. The specialist usually spends much more time with the patient than the doctor or the nurse does, as the specialist is responsible for caring for the daily needs of the patient. Because of this close relationship with the patient, the specialist has an extremely important role in patient care. The specialist can contribute immeasurably to a patient's recovery by his attitude toward duties on the ward, his attitude toward patients, his attention to duty, his personal hygiene habits, and his personal relationship with patients. The specialist is in a position to observe significant signs and symptoms. He must be alert to these indicators of a patient's health and report them to the doctor or the nurse. The

causes of discomfort should be observed and recognized by the specialist and prompt relief of discomfort given. The specialist should be alert and interested when the patient tells his wants, expresses worries and fear, or admits pain. Tact and understanding shown by the specialist can help to increase the patient's confidence in hospital personnel. The following points are good ones for both the specialist and the corpsman to remember when attending patients:

a. Get to know your patients. Be friendy to all, but not familiar.

b. Be alert and interested. Learn to recognize signs and symptoms.

c. Be skillful. Learn the routine procedures so that they can be performed with the least discomfort to your patients.

d. Win the cooperation of patients. Explain to each patient the treatment planned for him. Tell him how he can help you to get the best results from it.

e. Protect the patient and yourself as well by using equipment properly, by following correct procedures of nursing, and by using medical asepsis.

f. Each day analyze your work and try to do a better job.

g. Be aware at all times of the importance of working harmoniously with others for the good of the patient.

Section II. BEDMAKING

371. General

Skill in making a bed to insure the comfort of the patient is one of the first accomplishments in the art of nursing. The bed must be well made, for the patient spends most or all of his time in it. If he is a bed patient, all of his activities are carried on while he is in bed: his meals are served, his bodily functions are attended, and medical treatments given. In spite of such heavy use, a well-made bed will remain free of wrinkles and comfortable. Beds are not always made in exactly the same way. They vary, depending upon the needs of the patient, the climate, and the procedures prescribed at each hospital. But they should always be made with clean linen, which is drawn smooth and fastened firmly at the corners. There should be enough covers and pillows to insure comfort. Beds in a ward should be made alike for uniformity of appearance, but this practice should not be permitted to interfere with the comfort and needs of the patients.

372. Making an Unoccupied Bed

a. Equipment. Assemble in following order:

(1) Pillow.
(2) Pillowcase.
(3) Blanket (number as needed).
(4) Rubber drawsheet.

(5) Sheets (four) (one is used as a spread).

(6) Mattress cover.

b. Procedure.

(1) Place the material for bedmaking on a chair nearby, and move the bedside table out of the way.

(2) Tighten the mattress cover to remove all wrinkles (A, fig. 107).

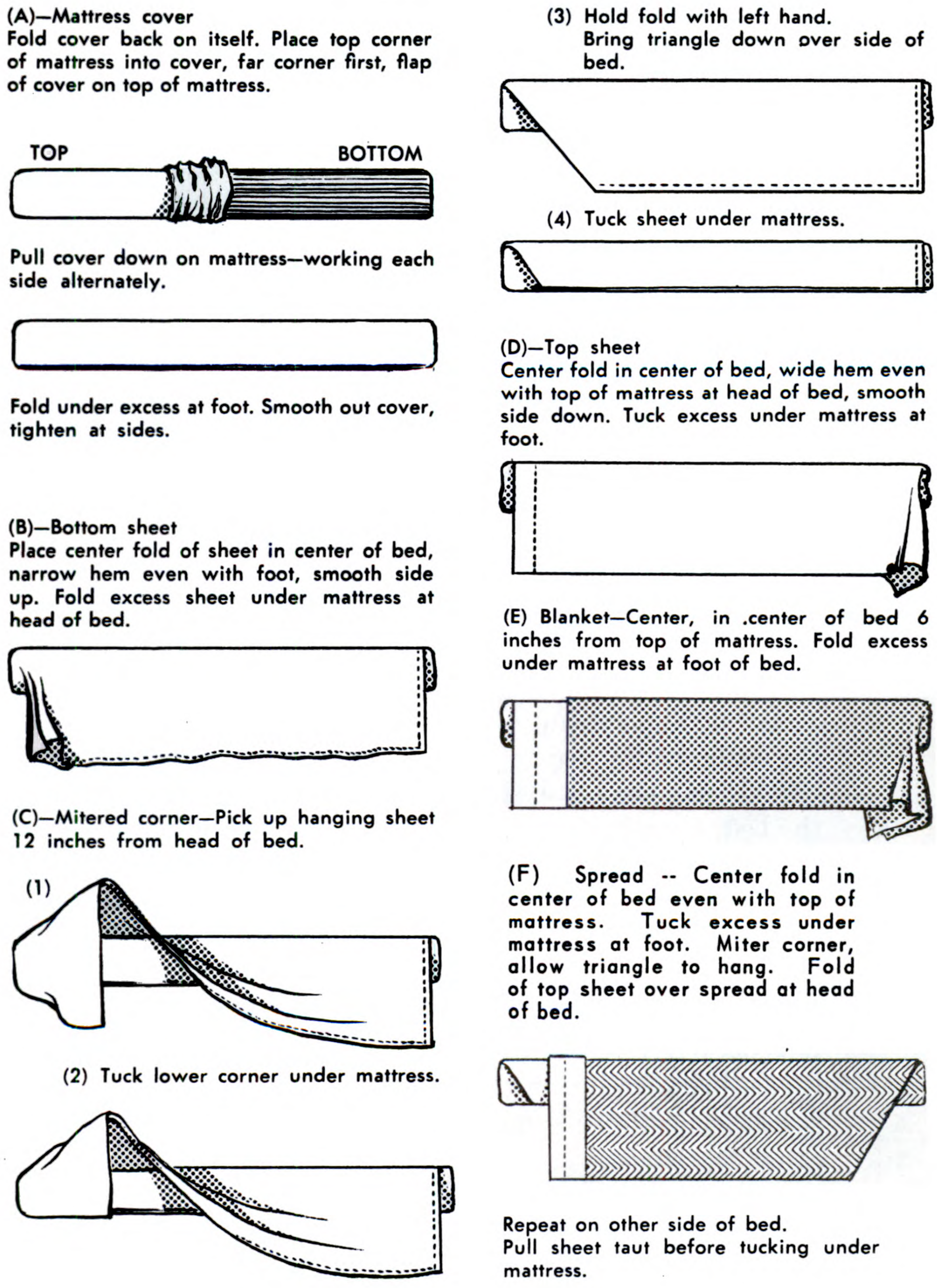


Figure 107. Making an unoccupied bed.

(3) Make one side of the bed completely, including the top covers, before you go to the other side.
(4) Place the bottom sheet on the bed with the bottom hem even with the foot of the mattress and with the excess at the head. Tuck excess under at the head of the mattress on your side (B, fig. 107). Miter the corner and then tuck the sheet under smoothly, along the side of the mattress from the head to the foot (C, fig. 107).
(5) Place the rubber drawsheet and tuck it under the mattress on your side of the bed.
(6) Place the muslin drawsheet. Be certain that it completely covers the rubber drawsheet and extends 2 or 3 inches beyond it on each side. Tuck it under the mattress on your side of the bed.
(7) Place the top sheet with its hem even with the top of the mattress and the excess at the foot (D, fig. 107).
(8) Place the blanket with its top edge approximately 8 inches or a hand span from the head of the mattress and the excess at the foot (E, fig. 107).
(9) If a fourth sheet is used as a bedspread, place its hem even with the head of the mattress and the excess at the foot.
(10) Now smooth and tuck the bedspread, blanket, and top sheet all at once under the foot of the mattress on your side. Miter the corner. Leave the sides hanging free (F, fig. 107).
(11) Fold excess of bedspread at the head of the bed *under* the blanket, and then bring the top sheet down over both to form a cuff.
(12) At this point, go to the other side of the bed.
(13) Fanfold the spread, blanket, and top sheet neatly back to the center of the bed.
(14) Fold back the draw sheets, one at a time, to the center of the bed.
(15) Smooth the bottom sheet, tucking in the excess at the head, and mitering the corner.
(16) Tighten and tuck in the remainder of the sheet along the side of the mattress from the head to the foot.
(17) Bring drawsheets over, one at a time, tighten, and tuck in separately.
(18) Now bring over the top sheet, the blanket, and the bedspread, smoothing them and tucking the excess at the foot. Miter the corner.
(19) Complete the cuff at the head of the bed.
(20) Put pillow slip on pillow and place neatly at the head of the bed, with the open end of the pillow slip away from the door.

(21) Return the bedside table and chair to proper places.

c. Preparing the Bed for Occupancy. If the bed is to be occupied by a patient, fold the covers down to the foot.

373. Making a Postoperative Bed

A postoperative, or anesthetic, bed is prepared to receive a patient returning from the operating room. The bed is protected with rubber sheeting.

a. Materials. You will need all the articles listed in paragraph 372*a*, as well as the following:

(1) Rubber sheet, 1.
(2) Bath towels, 2.
(3) Hand towels, 2.
(4) Washcloth, 1.
(5) Rubber or plastic pillowcase.

b. Procedure. Make the bottom of the bed as described in paragraph 372*b*, except place the extra rubber drawsheet at the top of the bed so that the mattress will be protected. Use two rubber drawsheets if necessary. A rubber sheet placed across the head of the bed must be covered with a towel. Place the top sheet, blankets, and spread as in paragraph 372*b*, but do not tuck them in. At the foot of the bed, fold the excess bedding back over itself to bring it even with the foot of the mattress. Fold top covers back neatly to the center of the bed. Place the pillow, protected by both a rubber and a cotton pillowcase, in an upright position at the head of the bed and anchor it by tucking it between the rods. Put the bath towel and washcloth in their places and pin a paper bag to the head of the bed. The complete setup of the postoperative unit is discussed in detail in paragraph 412.

374. Stripping a Bed

As you remove the bedclothes, place all items to be laundered in the linen hamper. Avoid letting the soiled linen touch your clothing or the floor. Carefully fold or roll all linen off the bed in order to avoid fanning it in the air. Fold any items to be reused (such as spread and blanket) and put on the back of a chair.

375. Changing a Bed Occupied by a Patient

a. Equipment. Assemble materials listed in paragraph 372*a*.

b. Procedure.

(1) Remove the pillow (if allowed). Place it on the back of the chair and the pillowcase in the linen hamper.
(2) Loosen the top covers at the foot. Remove the spread and blanket, leaving the top sheet to cover the patient.
(3) Bathe the patient.
(4) Pull up the mattress if it has slipped down in the bed.

(5) Turn the patient to the side of the bed toward you, keeping him covered.

(6) Fanfold the cotton drawsheet and then the rubber drawsheet close to the patient's back (fig. 108).

(7) Fanfold the bottom sheet in the same manner as the drawsheets.

(8) Tighten the mattress cover on your side.

(9) Place the clean bottom sheet over the exposed part of the mattress and fanfold it next to the soiled bottom sheet. Tuck it at the head.

(10) Miter the corner and tuck the sheet smoothly along the side.

(11) Bring the rubber drawsheet across the bed. Smooth and tuck under.

(12) Put on the cotton drawsheet, fanfold excess at center, and then tuck under.

(13) Fold all extra linen under the patient as smoothly as possible.

(14) Place a clean top sheet over the patient and instruct him to hold it while you remove the soiled sheet by pulling it out at the foot of the bed.

(15) Now place a blanket and a spread over the patient.

(16) Tuck the top bedding underneath the mattress on your side.

(17) Miter the corner and turn back the cuff at the head of the bed.

Figure 108. Changing a bed occupied by a patient.

(18) Turn the patient toward you, and then go to the opposite side of the bed.
(19) Fold the clean top covers neatly against the patient's back.
(20) Loosen the bottom covers alongside the mattress. Remove the soiled cotton drawsheet and place in the linen hamper.
(21) Fold the rubber drawsheet neatly close to the patient's back. Remove the soiled bottom sheet and place in the linen hamper.
(22) Tighten the mattress cover.
(23) Pull the clean linen through and tuck the bottom sheet under at the head of the bed. Miter the corner. Tighten and tuck it smoothly along the side of the mattress.
(24) Bring the drawsheets over, smooth and tuck under.
(25) Bring top covers over. Tuck under excess at foot of bed. Miter corner. Complete the cuff at the head of the bed.
(26) Place the pillow slip on the pillow and replace under the patient's head and shoulders.
(27) Leave the patient in a comfortable position, and see that he has fresh water.
(28) Leave the unit neat and orderly, removing all unnecessary equipment. Return the chair and the bedside stand to their proper places, and put the bedside stand in order. Leave clean towels and a washcloth in their proper places and a paper bag pinned to the head of the bed. Secure the patient's signal cord within easy reach. Damp dust the bed, the bedside table, and the chair.

Section III. PATIENT HYGIENE

376. Importance of Patient Hygiene

Patient hygiene consists of the care relating to the cleanliness of the patient, including bathing and the care of the skin, the mouth, the nails, and the hair. Cleanliness adds to the comfort of the patient and contributes to his feeling of well being, which is essential for a good mental outlook.

377. A.M. Care

The term "A. M. care" refers to the early morning care given the patient before breakfast. It is given in the morning when the patient first awakens, and is usually the responsibility of the night corpsman. The patient must be given an opportunity to void, to wash his face and hands, and to brush his teeth before breakfast.

a. Equipment.

(1) Urinal and/or bedpan according to the needs of the patient.
(2) Glass of water.

(3) Emesis basin.
(4) Basin of warm water.

b. Procedure.

(1) Offer bedpan and/or urinal.
(2) Elevate the head of the bed if permitted.
(3) Assist as needed in washing his hands and face.
(4) Place a towel under the patient's chin.
(5) Prepare his toothbrush and tooth paste.
(6) Assist as needed. Hand him the glass of water to rinse his mouth and hold the emesis basin along the curve of his cheek.
(7) Change linen if it is wet or soiled.
(8) Straighten top bedding.
(9) Remove unnecessary equipment from the bedside table.

c. Care of Equipment.

(1) Thoroughly rinse the toothbrush and replace in the bedside cabinet.
(2) Clean and replace all other equipment.

378. The Cleansing Bath

a. General. The cleansing bath is given to cleanse, to relax, to refresh the patient, and to stimulate circulation. The cleansing bath may be a bed bath, a tub bath, or a shower. The choice of bath is determined by the patient's condition and the facilities available. The specialist is responsible for making certain that the ambulatory patient takes a bath and for assisting him as necessary. If the bed patient can bathe himself, the specialist is responsible for supplying him with the necessary equipment and for bathing and rubbing his back. The specialist gives the complete bath if the patient is unable to bathe himself, observing the skin for signs of pressure.

b. Equipment for Cleansing Bed Bath.

(1) Basin of warm water.
(2) Emesis basin.
(3) Glass of water.
(4) Rubbing alcohol.
(5) Talcum powder.
(6) Soap.
(7) Clean pajamas.
(8) Towels.
(9) Washcloth.
(10) Bed linens—sheets and pillowcase.

c. Procedure.

(1) Screen the patient to provide privacy.
(2) Give, or assist, with oral hygiene (par. 377*b*).

(3) Remove pillow, place it on the back of the chair.
(4) Remove top covers, leaving only the top sheet to cover the patient during the bath.
(5) Unbutton and remove the pajama coat.
   (*a*) Turning the patient slightly toward you, remove his far arm from the sleeve and tuck the pajama coat under him.
   (*b*) Lifting the near shoulder, pull the pajama coat through and complete removing it.
(6) Remove pajama pants.
   (*a*) Loosen and pull below the hips, keeping the patient covered with the sheet at all times.
   (*b*) Standing at the side of the bed, pull the pants off over the feet.
(7) Place pajamas in the linen hamper.
(8) Wash face.
   (*a*) Place a bath towel under the patient's head to protect the mattress.
   (*b*) Dampen the washcloth and secure it in the hand in such a way that there are no dangling ends.
   (*c*) Bathe eyelids, using a different portion of the cloth for each eye.
   (*d*) Apply soap to the washcloth and bathe his face, ears, and neck.
   (*e*) Rinse and dry well.
(9) Shave the patient if necessary, as it will add to his comfort, morale, and appearance.
(10) Empty and clean the basin and refill it with warm water.
(11) Wash the upper extremities.
   (*a*) Expose the arm farthest from you and place a fully opened bath towel under the arm and shoulder.
   (b) Using long, firm strokes, bathe, rinse, and dry the arm to the wrist, paying particular attention to the armpit.
   (*c*) Fold the towel in half and place it under the hand.
   (*d*) Place the basin on the towel, and the patient's hand in the basin.
   (*e*) Wash the hand well. Trim and clean fingernails if indicated.
   (*f*) Remove the basin and dry the hand.
   (*g*) Cover the hand and arm with the sheet.
   (*h*) Expose the arm nearest you and bathe it in the same manner.
(12) Wash the chest and abdomen.
   (*a*) Expose the chest and place a towel over the upper edge of the sheet.
   (*b*) Bathe, rinse, and dry the chest, using long, firm strokes.

(*c*) Cover the chest with a towel and expose the abdomen and hips, leaving the pubic area covered.
(*d*) Bathe, rinse, and dry the abdomen.
(*e*) Cover the abdomen and chest with the sheet.
(*f*) Change the water.

(13) Wash the lower extremities.
(*a*) Expose the leg farthest from you and place the fully opened towel under it.
(*b*) Instruct the patient to bend his knee. Drape the sheet securely to avoid exposure.
(*c*) Bathe, rinse, and dry the leg down to the ankle.
(*d*) Place a folded towel under the foot.
(*e*) Place the basin on the towel and the patient's foot in the basin.
(*f*) Wash the foot, paying particular attention to the skin between the toes, and cleaning and trimming the toenails (fig. 109).
(*g*) Remove the basin and dry the foot.
(*h*) Repeat this procedure for the leg nearest you.
(*i*) Change the bathwater.

Figure 109. Bathing a patient.

(14) Wash the back.

(*a*) Turn the patient to a comfortable position in which his back can be readily exposed and reached.

(*b*) Expose the entire back and buttocks.

(*c*) Place the towel lengthwise on the bed, close to his back.

(*d*) Bathe, rinse, and dry his back, paying particular attention to the sacral and anal area.

(*e*) Rub the back with alcohol (or with lotion, if the skin is dry), using long, firm strokes, starting from the base of the spine and rubbing up and out over the shoulders. Follow with light dusting of talcum powder.

(*f*) Turn the patient to his back.

(15) Cleanse the pubic region.

(*a*) Place the towel under the patient's hips.

(*b*) Assist him as necessary.

(*c*) Remove and discard the towel.

(16) Put pajamas on the patient and comb his hair.

(17) Remake the bed (par. 375).

d. Care of Equipment.

(1) Remove all equipment to the utility room.

(2) Clean and store it as prescribed.

379. P.M. Care

The term "P.M. care" refers to the evening care given the patient. It is usually given after the evening meal, by the corpsman on evening duty. This care is important, for it refreshes the patient and promotes relaxation and sleep.

a. Equipment.

(1) Bedpan and/or urinal.

(2) Glass of water and emesis basin for oral hygiene.

(3) Basin of warm water.

(4) Soap.

(5) Rubbing alcohol.

b. Procedure.

(1) Offer the patient the urinal and/or bedpan.

(2) Allow the patient to wash his hands and face. Assist as needed.

(3) Assist with oral hygiene as needed.

(4) Wash the patient's back with soap and water. Give a back rub.

(5) Tighten bottom bedding; straighten top bedding.

(6) Remove unnecessary equipment from the unit.

(7) Provide fresh drinking water for the patient if it is permitted.

380. PRN Care

a. General. The term "PRN care" refers to the care given whenever needed, day or night. It is given to cleanse the patient and/or promote comfort. The amount of PRN care needed varies with the individual patient. Seriously ill patients will need a great deal; ambulatory patients require very little. PRN care may include any or all of the following: special mouth care, bath (complete or partial), back rub, changing or straightening of bed linen, changing of position, and special skin care.

b. Mouth Care. This includes patients who are unable to assist in brushing their teeth and must have their mouth and teeth cleaned by other means.

(1) *Equipment.*

(*a*) Toothbrush (if the patient is able to help by rinsing his mouth).

(*b*) Tongue blade.

(*c*) Cotton tipped applicator.

(*d*) 4 x 4 gauze sponges.

(*e*) Mouthwash.

(2) *Procedure.*

(*a*) Wrap the end of a tongue blade with 4 x 4 gauze and moisten it in the mouthwash.

(*b*) Clean teeth, beginning with the front teeth and working to the back of the mouth.

(*c*) Change and remoisten the gauze as necessary until the entire mouth is clean.

(*d*) Clean the inside of the mouth, cheeks, and tongue in same manner.

(*e*) Use cotton tipped applicators moistened with mouthwash to clean between the teeth and close to the gums.

(*f*) Keep the tongue, mouth, and lips lubricated with mineral oil if they are dry.

c. Skin Care.

(1) *General.* Skin care is given to prevent pressure or bed sores (decubitus ulcers) (fig. 110). Pressure sores are a break in the skin caused by friction, pressure, moisture and/or irritation of the skin. They occur particularly over the boney prominences (sacral area, ankles, etc.). The symptoms are redness (first stage), bluish discoloration (second stage), and ulcerations (third stage). With good care most pressure sores can be prevented.

(2) *Preventive measures.*

(*a*) Keep the skin clean and dry. Bathe as often as necessary with soap and water. Rinse and dry well.

(*b*) Change linen as soon as it becomes wet or soiled.

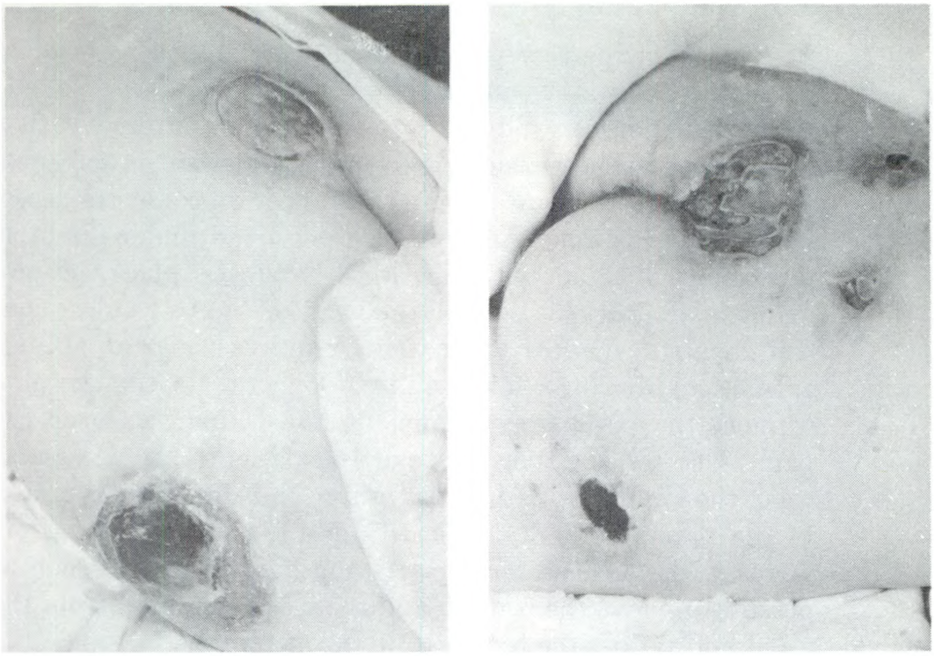


Figure 110. Bed sores.

(*c*) Keep linen smooth and wrinkle free.
(*d*) Massage the skin over boney prominences frequently.
(*e*) Change the position of the patient frequently.
(*f*) Relieve pressure by the use of pillows and comfort devices (par. 390).

381. The Urinal

a. Before bringing a urinal to the bed, cover it with a cloth. Give it directly to the patient; never leave it on top of his bedside stand or on the floor by the patient's bed. The patient should wash his hands after using the urinal. Before discarding the urine, be sure to note its color and the amount. If an output record is being kept, write on it immediately the time of voiding and the amount. If the appearance of the urine is not normal, save a specimen for the doctor to examine. A small amount of blood will make urine look smokey; a large amount causes it to appear red.

b. In cleaning the urinal, always wash it first with cold water, as body discharges contain protein—a substance easily soluble in cold water. Hot water causes the protein to coagulate and stick to the walls of the container. The deposit is then very difficult to remove. Disinfect the urinal in the same way as described later for bedpans.

382. Use of the Bedpan

a. Frequency. A patient should be given a bedpan each time he requests it.

b. Procedure.

(1) Warm the bedpan by placing it in a warming cupboard or by letting hot water run inside it.

(2) Carry toilet paper and the warmed bedpan covered with a clean cover to the bedside. See that the patient is screened. If he requires assistance to use the pan, two people are necessary. Flex his knees and, placing one hand under his hips, raise him gently as with the other hand you place the pan under his buttocks. Elevate the head of the bed unless contraindicated. Unless the patient requires constant attendance, leave him for a few minutes. When removing the pan, support the patient as in placing the bedpan. Cover the pan. Use toilet paper to clean the patient. If necessary, wash the anal area with warm water and dry it thoroughly. If the patient is able to clean himself, provide him afterwards with warm water for washing his hands. As soon as possible, remove the bedpan and the basin of water from the ward and return the screen to its proper place.

(3) Before disposing of the contents of the bedpan, examine them for amount, color, consistency, blood, pus, and mucus. If in doubt, keep a specimen for inspection by the ward officer. Clean the bedpan. Record the patient's bowel movement in the defecation column of the Temperature Sheet.

383. Cleaning the Bedpan

a. The steam sterilizer and washer for the bedpan and urinal utilizes cold water under pressure for cleansing, and live steam for disinfection. Open the door of the sterilizer by stepping on the foot pedal; place the bedpan and its contents in the sterilizer, and close the door (fig. 111); set the controls to clean and disinfect the bedpan. In two or three minutes, you may remove the bedpan from the sterilizer and place it on the rack or in the patient's own bedside table.

b. When the special sterilizer and washer, are not available, flush the pan first with cold water and then scrub it thoroughly with hot, soapy water and a brush. Place the pan in a steam sterilizer (fig. 112) or in boiling water for 5 minutes. If there are no facilities for boiling, place the pan in the chemical disinfectant used by the individual installation. Rinse with water prior to re-use.

384. The Cleaning or Evacuating Enema

a. Purpose. A cleansing or evacuating enema may be ordered if the number or character of stools indicates improper elimination, if the intestinal tract is abnormally distended by gas, or if the bowel must be empty for an examination or an operation. For some operations the order requires that the enema be repeated until the return is

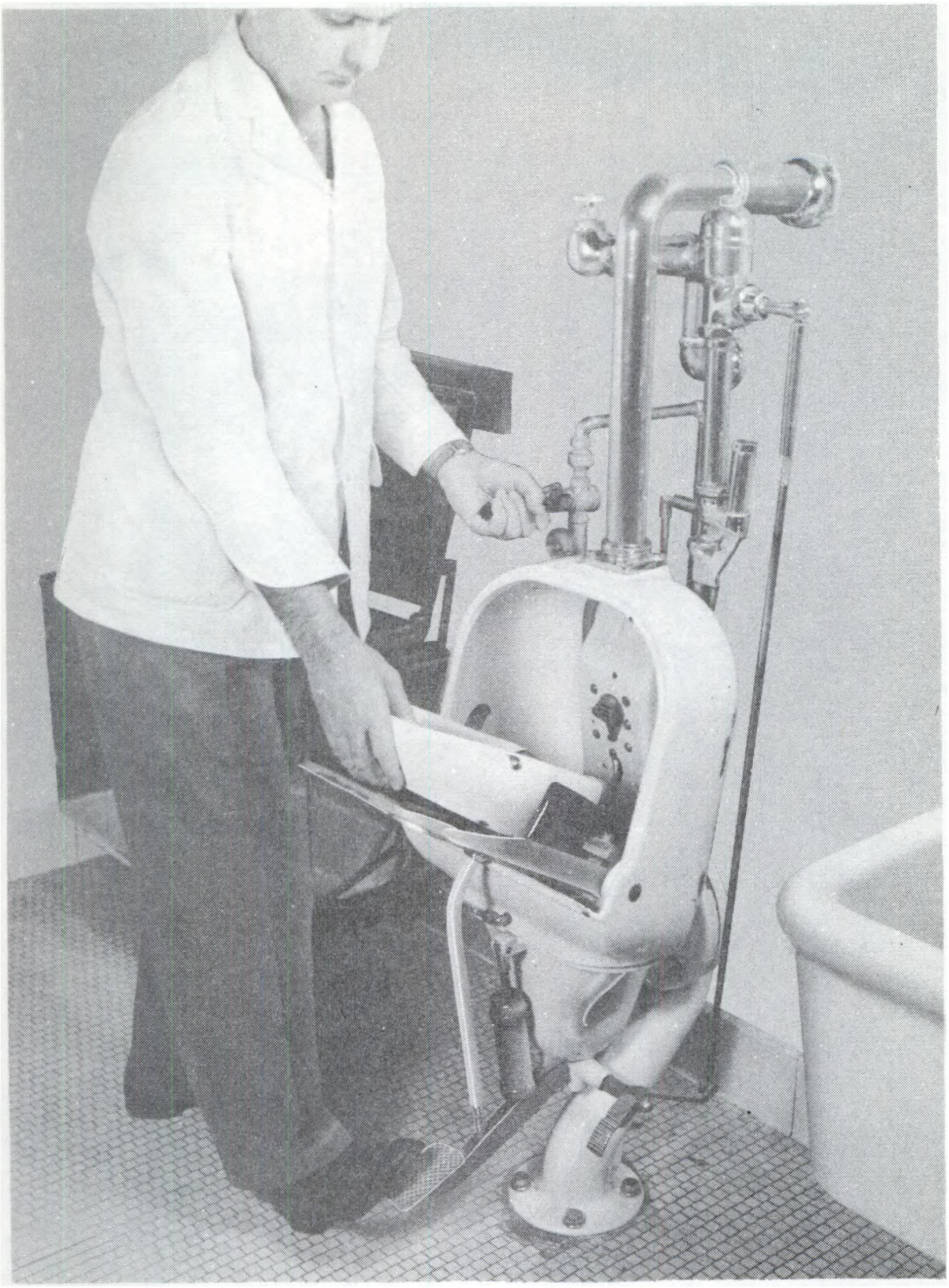


Figure 111. Sterilizer and washer for bedpan and urinal.

clear. The purpose of an enema is to soften hardened fecal matter and to stimulate the contraction of the colon by distending its walls or by the use of a prescribed irritant.

b. Solutions. The solutions most frequently used in cleansing enemas are a weak soap solution (always use a mild soap), plain tap water, salt (1 teaspoonful to a pint of water) or soda bicarbonate (1 teaspoonful to a pint of water). The volume varies from 500 to 1,000 cc. unless a definite amount is prescribed.

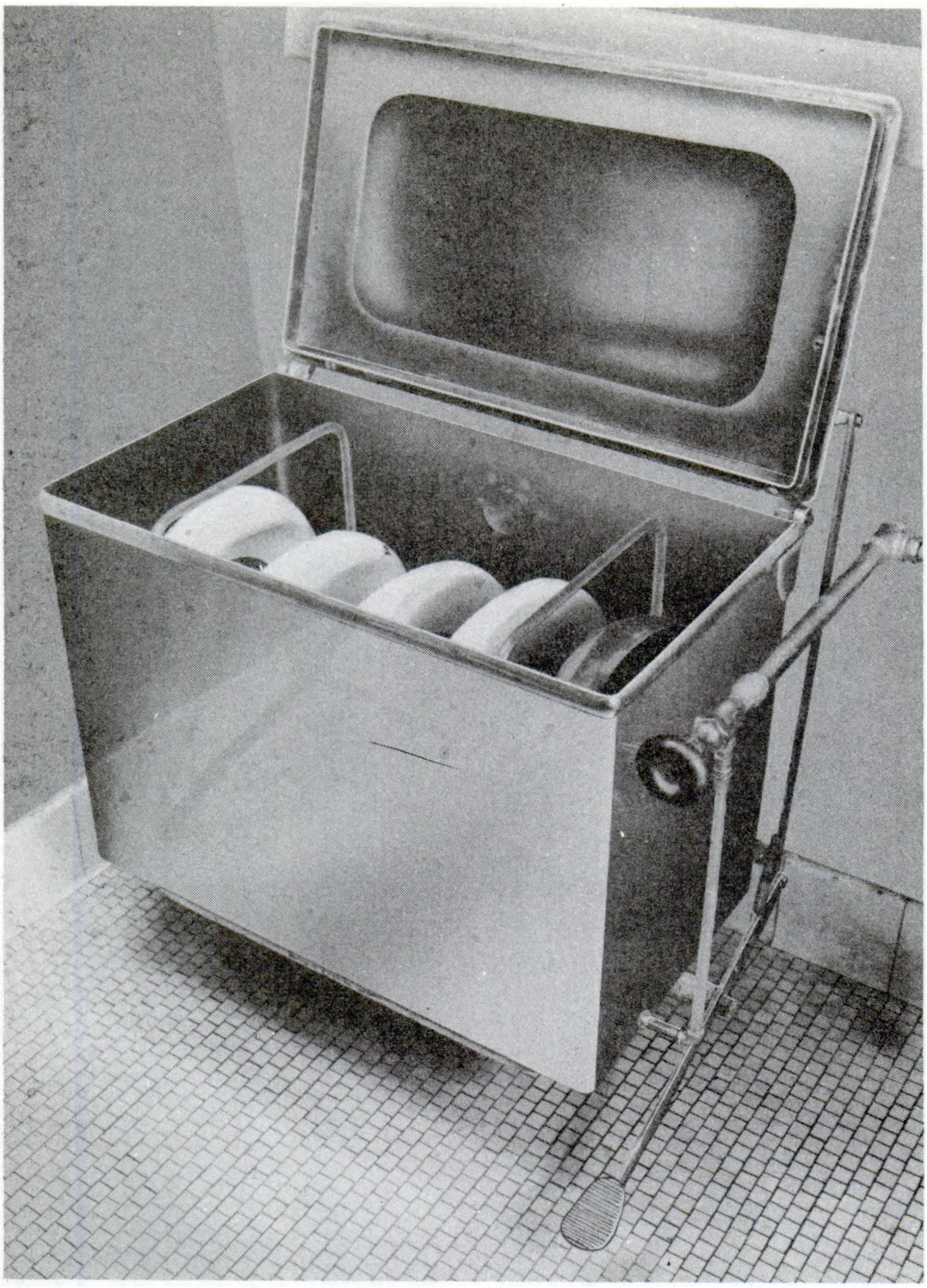


Figure 112. Bedpan sterilizer.

c. Equipment. The equipment listed below is prepared in the utility room (fig. 113). Sometimes disposable type enema equipment, which already contains the solution, is used instead of (2) below.

(1) Bedpan and cover.

(2) Irrigating can with rubber tubing, tubing clamp, glass connecting tube, and rectal tube (all connected).

(3) Lubricant.

(4) Toilet paper.

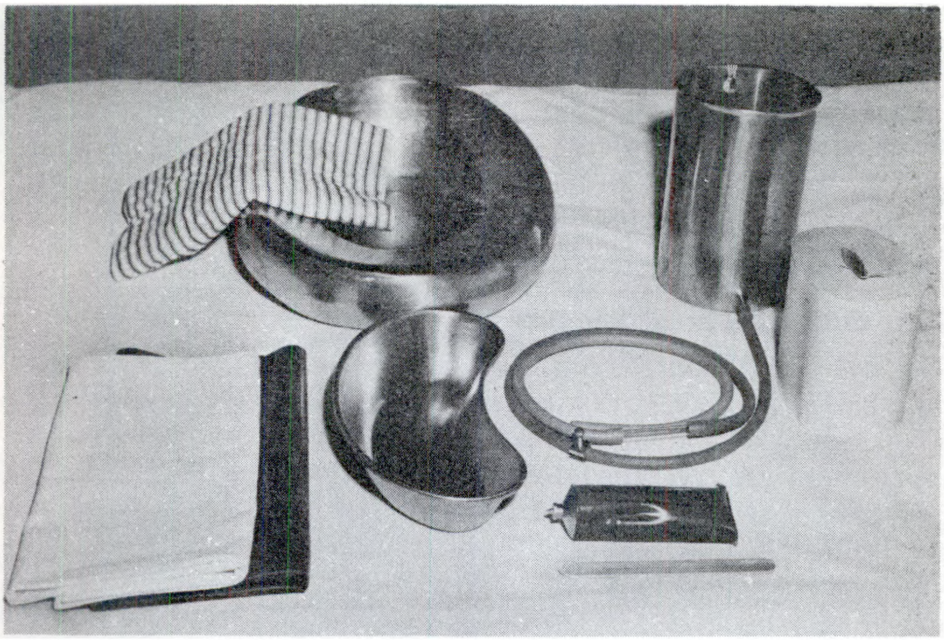


Figure 113. Enema equipment.

(5) Rubber treatment sheet with muslin cover.
(6) Emesis basin for waste.
(7) Utility thermometer.

d. Procedure. Carry all equipment to the patient's bedside. Preparation includes preparing the solution ordered and placing it in the irrigating can (unless otherwise specified, the temperature should be 105° to 110° or warm to the wrist); lubricating the rectal tube; and warming and covering the bedpan. Screen the bed if in an open ward. Remove all pillows except one, and place the treatment sheet and cover under the patient's buttocks to protect the bed. Turn the patient on his left side with the right knee flexed and drawn well up to the abdomen. Drape the patient with the top covers so there is no unnecessary exposure. Elevate the irrigating can and allow a small amount of the solution to run through the tubing into the pan to clear the tubing of air. Close the clamp, lower the irrigating can, and insert the lubricated tube into the patient's rectum 3 or 4 inches. Instruct the patient to breathe through his mouth to relax the abdominal muscles. Let the fluid run slowly. The rate of flow is regulated by the elevation of the irrigating can; therefore, hold the can about 18 inches above the patient's hips. If the patient complains of discomfort, clamp the tubing for a few seconds and then continue more slowly. When the required amount of fluid has been given, clamp the tubing, withdraw the rectal tube, and wrap the soiled end in toilet paper. Encourage the patient to retain the solution for 5 to 10 minutes. Instruct him to turn on his back, and place him on the bedpan as directed in paragraph 382. Patients who are unable to

retain enemas may be given an enema while on the bedpan. Clean and disinfect the bedpan. Clean the enema equipment according to routine procedure, using a brush to clean the rectal tube. Disinfect the enema equipment by boiling it for 10 minutes in a utensil sterilizer, or if that cannot be done, by immersing it in the disinfectant solution recommended by the hospital. Record time, type, and amount of enema solution given, and results.

385. Other Types of Enemas

a. The Carminative Enema. Irritants such as glycerin or magnesium sulfate are sometimes added to the solution to stimulate the bowel. Such a solution is called a *carminative enema* for it causes expulsion of gas from the intestine.

b. The Oil Retention Enema. An oil retention enema is sometimes given to soften fecal matter and to aid in its expulsion. Cottonseed oil is ordinarily used for enemas. The amount, if not specified in doctor's orders, should be from 3 to 5 ounces. This small amount is given by a funnel and a colon tube rather than with an irrigating can. An oil retention enema is sometimes given in the evening and followed by a cleansing enema the following morning. It differs from a cleansing enema in that the oil must be warm and the patient must hold the oil for a minimum of 15 minutes. Extra protection with rubber sheets is necessary when an oil retention enema is given.

386. Insertion of Suppository

In some cases the doctor orders that the patient have a suppository inserted. A suppository is composed of concentrated soap, glycerin, or plain or medicated cocoa butter and is usually in the shape of a cone. When introduced into the rectum, it is dissolved by body heat. Soap and glycerin suppositories are occasionally used to stimulate defecation; medicated suppositories are a method of administering medication. Turn the patient on his side. Put on a finger cot or a rubber glove. Remove the protective wrapping from the suppository. Rub a small amount of petrolatum on the suppository and insert it well up into the rectum. Instruct the patient to lie still for a few minutes in order that he may not expel the suppository before it has had time to melt and take effect.

Section IV. PATIENT COMFORT

387. General

The physical comfort of a patient is highly important to his mental ease, to his morale, and to his progress and recovery. Making him comfortable, therefore, is one of the principal objectives in good nursing care. In addition to the care described in sections II and III, this chapter, there are certain special techniques and devices which assist

in providing comfort to the patient. These include providing a pleasant environment in the patient's unit, proper positioning of the patient in his bed (including the use of positioning devices), proper lifting, moving, or turning of the bed patient, and use of other miscellaneous comfort measures.

388. Environmental Factors

The patient unit should be made as attractive and comfortable as possible. Disagreeable odors, drafts, and unnecessary noise should be eliminated. Check also for glare from artificial lights or from the sun. When the patient desires privacy, try to provide it with screens or curtains if he is on a ward.

389. Positioning the Patient in Bed

a. The Importance of Correct Positioning and of Changing the Position of a Patient. Correct positioning of the patient in his bed and attention to body alinement will contribute much to his comfort. If he is unable to move himself, his position must be changed every hour by the specialist. If he can move himself, he must be checked frequently anyway to insure that his body is in good alinement and that he does not remain in one position too long.

b. Adjusting the Hospital Bed. The bed used in most hospitals can be adjusted in several ways for the comfort of the patient. The parts of the bed under his head and knees may be raised or lowered by handles at the foot of the bed.

c. Good Body Alinement of the Bed Patient. Whether a person is lying on his back, face, or side, the following points should be remembered: back straight; legs flexed to relieve strain on lumbar spine, abdomen, and legs; ribs elevated to enlarge the rib cage or prevent constriction; legs supported and placed so that the weight of one does not fall on the other; extensive ankle extension prevented; hands and arms supported. There are many modifications of the lying position which can be made to provide for comfort and there are a variety of aids which can be used such as pillows, sand bags, splints, casts, and cradles. These aids are frequently used on the ward to provide support to the patient and maintain good body alinement. When a person is lying on his back, a small pillow placed under his neck will aid in good alinement and will prevent the head from rolling sideward. When he is lying on his face, a small pillow placed under the abdomen prevents exaggeration of the lumbar curve. If his head is turned to one side, the neck can be supported by fitting a small pillow between it and the bed. If he is lying on his side, you should seek to maintain the good alinement of the trunk and support the head in line with the midline of the trunk. Rotation of the spine should be avoided. If possible, a person's position should be changed frequently from

back-lying to front-lying and from one side to the other in order to prevent weight from remaining constantly on the same body surface. Undue fatigue can also be prevented by alternating sitting with lying down. Good muscle tone is maintained by intermittent rather than by sustained contraction and relaxation. No matter how comfortable a position is at first, it will become tiring if maintained for any length of time.

d. Moving the Patient up in the Bed. There is a tendency for the patient to slip down toward the foot of the bed, even when there is only a slight elevation at the head of the bed. If it becomes necessary to move a helpless patient up in the bed, get someone to help you. Lower the head of the bed and remove the pillow from under the patient's head. Standing on opposite sides of the bed, you and your assistant should place one foot ahead of the other so that weight will be shifted from one leg to another as the patient is moved. Place one arm under the patient's neck and shoulders and the other arm under the patient's hips. At a given signal slide the patient toward the head of the bed. Replace the pillow while you support his head. If the patient is able to assist you, remove the pillow from under his head and instruct him to grasp the head of the bed with both hands and to flex his knees. He can then push with his feet and pull with his hands at the same time while you assist him by placing one of your arms under his back and shoulders and one under his buttocks. On a given signal, lift the patient as he pulls and pushes.

e. Turning a Patient. To turn a patient, stand at the side of the bed toward which the patient is to be turned. Place one of your arms on his far shoulder and your other arm on his far hip. Gently roll the patient toward you. Move his hips toward the center of the bed, extend his lower leg, flex his upper leg. Rearrange the pillow under his head and place his arms in a comfortable position. Other pillows may be used to support his back and to assist in positioning him.

390. Other Measures for Physical Comfort of the Patient

a. Bed Cradle. A bed cradle (fig. 114) is used to relieve the abdomen, the extremities, or any other part of the body, of the weight of the bed clothes. There are many different types of cradles. Additional bed clothes, to keep the patient warm, must be added when a cradle is used. Tying the bed cradle to the bed will prevent its slipping from the bed.

b. Rubber Rings. Rubber rings inflated one-third to one-half full of air may sometimes be used to relieve pressure on the buttocks. It is of particular value for emaciated patients and for very large patients. Always cover the ring with a pillowcase to pre-

Figure 114. Bed cradle.

vent skin irritation from the rubber. Have the pillowcase free from wrinkles. Place the ring under the patient with care; to avoid injuring the patient with the valve of the rubber ring, make sure that the valve is on the side away from the body. In using rubber rings you are not *relieving* pressure but merely changing the area of pressure; therefore you must still watch for pressure sores.

c. Footrest. A footrest against which the feet may be placed is an important comfort device and a protective one as well. The normal position of the foot is at right angles to the leg. If a patient lies on his back for a long time, a condition commonly known as "foot drop" develops. Prevent this by placing between the end of the mattress and the foot of the bed a box, a firmly rolled pillow or blanket, or a board against which the patient's feet rest. This device will also help to maintain good posture by preventing the patient's sliding down in the bed.

d. The Wheel Chair.

(1) *Equipment needed.* Placing a patient in a wheel chair or assisting him to move himself into one is a procedure often used for comfort as well as for transportation of the patient. You will need the following equipment:

(*a*) Bathrobe and slippers.
(*b*) Wheel chair.
(*c*) Footstool.

(2) *Procedure.* Place the wheel chair (not reclining) with the footrests elevated parallel to the side of the patient's bed.

The patient, after being dressed in the usual manner, sits on the side of the bed, faces the chair, stands, and half turns to get into the chair. Support him under his arm with one hand and hold the arm of the chair with the other hand. Help the patient to seat himself. Next, adjust the foot- and leg-rests, and place blankets over knees or around shoulders, as needed.

(3) *Care of patient while he is up.* The patient should be up no longer than 30 minutes the first time or as ordered by the doctor. Observe him at frequent intervals to see that he is warm and comfortable; check his pulse and color. Watch for symptoms of fainting, and return him to bed at once whenever he shows signs of fatigue.

(4) *Care of the patient's bed.* Straighten the bed as soon as he is up so that it will be ready when he returns to it.

Section V. FEEDING THE PATIENT

391. General

Food is any substance taken into the body, that is capable of producing heat, building tissue, or repairing tissue. It includes both fluids and solids. Diet is a particular selection of foods necessary to maintain normal health or to cure or prevent disease. Proper nutrition, therefore, is an essential part of the treatment and care of the patient. Diets are ordered for the patient by the doctor. They vary according to the patient's needs. In an Army hospital all diets are planned and prepared by the Food Service Department. Ambulatory patients who eat on the ward and bed patients may be served by the medical corpsmen and medical specialists.

392. Types of Standard Hospital Diets

a. Regular Diet. The majority of patients are given a regular diet. There are no restrictions as to the kinds and amounts of food as long as the diet includes the minimum daily requirements of the basic nutritional elements. As in all diets, the basic elements are carbohydrates, proteins, fats, minerals, and vitamins.

b. Light Diet. This diet has few restrictions. It is a stepping stone between the soft and regular diets. It is composed of easily-digested foods; fried and highly-seasoned foods are not allowed. It is especially suitable for patients who are recovering from an acute illness, but who are still confined to bed and have no desire for a regular diet.

c. Soft Diet. A soft diet consists of foods that are low in roughage and are easily digested. It is frequently ordered when mechanical

irritation in the digestive tract must be reduced. Soft diets bridge the gap between liquid and light or regular diets and are suitable for patients during certain stages of postoperative recovery or during convalescence from some intestinal disorder.

d. Liquid Diet. This consists of all fluids and of foods which melt at body temperature. They must be easily digested, must be in a concentrated form, and must be free from condiments and mechanical irritants. Such diets are usually given in small portions and at frequent intervals, depending upon the patient's condition.

393. Variations

Variations in the above standard diets are sometimes ordered to meet a patient's particular needs. For example, foods may have to be chopped, pureed, or mashed for a patient without teeth or for one with a broken jaw. For an unconscious patient, or for one who refuses to eat, or for children who cannot eat, foods may have to be made into liquid form and given to the patient through a tube (par. 449). Other frequent variations from the standard diets are those diets prescribed for patients with diabetes, with heart disease, or with kidney diseases. No substitutions or changes in a patient's diet are allowed without consulting the dietitian.

394. Responsibilities of the Specialist at Mealtime on the Ward

As a medical corpsman or a medical specialist you must not only be familiar with the types of diets given to patients, but you must also know how to serve the patient and give assistance to him before, during, and after mealtime. You must also seek to provide an environment that will stimulate in him a desire to eat the prescribed diet.

a. Prepare Yourself. Wash your hands before you serve the patient. Check your appearance; seek to appear neat and well groomed. Refrain from smoking.

b. Prepare and Assist the Patient.

(1) *All patients.*

(*a*) Offer the bedpan.

(*b*) Provide handwashing facilities or wash the patient's hands.

(*c*) Clear the table and place it within reach of the patient.

(*d*) Place him in a sitting position unless the doctor has ordered otherwise.

(*e*) Serve the tray promptly.

(*f*) Avoid spilling the food while carrying the tray.

(*g*) Check the name on the tray card to assure that the right diet is given to the right patient.

(*h*) Remove the tray as soon as the patient has finished eating.

(*i*) Leave the patient in a comfortable position with the bedside table and call bell within reach.

(2) *Semi-helpless patients.* In addition to the duties delineated in (1) above, when you are serving a semi-helpless patient, you must do the following:

(*a*) Arrange the food and utensils within reach of the patient.

(*b*) Prepare the food, as necessary; for example, cut the meat, butter the bread.

(3) *Helpless patients.* These patients will require the following additional assistance from you:

(*a*) Place the tray on the table in such a way that the patient can see what is on it.

(*b*) Stand or sit in a comfortable position for feeding the patient.

(*c*) Provide him with a napkin.

(*d*) Ask him to suggest the foods he desires.

(*e*) Allow time for chewing and swallowing.

(*f*) In giving him fluid, use a straw.

(*g*) In feeding him with a spoon, fill the spoon two-thirds full and remove the drip from the bottom by passing the spoon over the edge of the cup. Touch the lower lip with the side of the spoon, exerting slight pressure, and raise the spoon slightly to allow the liquid to flow gently into his mouth.

(*h*) In feeding him through a glass tube or straw, keep the straw below the level of the liquid to prevent his swallowing air. For a patient who is lying flat, use a curved straw.

(*i*) Encourage him to take all the foods and liquids on the tray.

(*j*) Converse with him while he eats.

c. Observe and Report Food and Fluid Intake. Always report to the nurse all bed patients who are not eating well or who refuse their diet. Report also all ambulatory patients who do not go to meals. If a fluid intake and output record has been ordered, keep an accurate record at the bedside.

d. Give Water and Extra Feedings as Ordered. Drinking water is usually provided at the bedside of each patient so that he can drink when thirsty. Sometimes, however, the doctor will restrict the amount or will order extra fluids or food between meals or at bedtime. Check the orders carefully and help the patient to observe them.

Section VI. TAKING TPR AND BLOOD PRESSURE

395. Importance of Accurate Measurement

Temperature, pulse, respiration, and blood pressure rates are relatively so constant that any marked deviation from the rate considered normal is looked upon as an important symptom of illness. Accuracy in measuring these vital signs is, therefore, of utmost importance. The specialist frequently will be assigned the duty of taking and recording these measurements. He must realize the importance of accurate performance of this duty. Temperature, pulse, and respiration are routinely taken according to hospital policy. Any marked deviation from the normal in these vital signs is a signal of distress sent out by the body. So important are changes in temperature, pulse, and respiration in diagnosing certain diseases and in recognizing stages of the disease, that a temperature chart is kept on most patients. On this chart are recorded, by means of dots and lines, the temperature and pulse curves, and the respiration and blood pressure rates. The temperature chart is usually the first sheet in the patient's clinical record file so that it is readily available for the doctor. Factors which influence body temperature are discussed in paragraph 76.

396. Measuring Body Temperature

a. General. Body temperature is measured in one of three ways: oral, axillary, rectal. The clinical thermometer is the measuring instrument. It varies from the long, slender mouth thermometer to the rectal thermometer made with a short fat bulb specially designed to prevent damage to the mucosa. The principle upon which the thermometer is based is that mercury expands with heat. In the self-registering thermometer the column of mercury remains at its height until shaken down. To shake the mercury down grasp the thermometer securely by the upper end, flex the hand, and give a quick movement of the wrist as if cracking a whip. Always shake the thermometer down to 95° F. or below. Be careful not to drop the thermometer or let it strike anything.

b. Reading the Thermometer. Hold the end of the thermometer stem at eye level so that the thermometer is horizontal. Rotate the stem between your thumb and fingers until you locate the mercury column. Read the corresponding degree markings and record immediately the results and the method you used to take the temperature. Temperature is recorded by writing it as a decimal: 98.6 for the normal oral temperature; 97.6A for axillary; or 99.6R for rectal.

c. Oral Temperature. The mouth is the most convenient place for taking temperature. To take the temperature by mouth, place the end of the thermometer containing the mercury under the tongue.

Here it is near the large blood vessels. Instruct the patient to keep his mouth tightly closed. Leave the thermometer in place for at least three minutes (fig. 115).

d. Rectal Temperature. There are times when the oral method of taking temperature is contraindicated such as during difficulty in breathing or when having hot or cold applications on the face or throat. Taking the temperature orally is also not advised for some elderly patients, for children, or for restless, unconscious or irrational patients. The rectal method is said to be the most accurate. Have the thermometer well lubricated and insert the bulb about one and a half inches into the rectum. Hold the thermometer in place to prevent its being expelled or broken. Five minutes is usually a sufficient time to leave the thermometer in place. Temperature taken

Figure 115. Oral thermometer tray.

in this manner will usually be ½° to 1° F. higher than oral temperature.

e. Axillary Temperature. When temperature can be taken neither orally nor rectally it may be taken under the arm. Before placing the thermometer in position, see that the axilla is free of perspiration. Place the bulb securely in the axilla and completely surround it with body tissues by placing the patient's arm over his chest with his fingers on the opposite shoulder. Leave the thermometer in position for at least 10 minutes. Do not allow the clothing to come in contact with the thermometer. Temperature taken in this manner will usually be about 1° F. lower than that taken by mouth.

f. Care of Thermometers. Clean the thermometer, after using it, with gauze saturated with the solution recommended by the hospital. Rinse it under cold water and immerse it in a disinfectant solution for 10 minutes. Then remove it from the solution, rinse it with cold water again, and dry it.

397. Counting the Pulse

The pulse is usually taken at the radial artery at the wrist, but other sites may be indicated such as the temporal artery in the temple, the carotid artery in the neck, the popliteal artery behind the knee, or the dorsalis pedis artery on the top of the foot. Take the pulse, if possible, while you are waiting for the thermometer to register. Apply digital pressure over the radial artery, compressing it with the tips of the fingers. Do not use your thumb as the thumb artery is relatively large and its pulsations may be confused with those of the patient's. The patient should be at ease physically and emotionally. If he is sitting, rest his forearm comfortably on a table or on the arm of a chair. If he is lying down, place his entire arm flat and limp on the bed to avoid a reduction of pulse due to mechanical depression of the artery at some proximal point. Count the number of beats per minute. The pulse rate varies with exercise, with disease, and with emotions, but is usually 60 to 80 beats per minute. The pulse usually increases about 10 beats per 1° F. of fever. Report at once any irregularity. A fast beat and a subnormal temperature may indicate shock due to blood loss or heart failure. A pulse rate of less than 60 is usually a grave symptom also. Besides the pulse rate, note also its strength and its rhythm. The strength of the pulse is the force with which the expanding artery hits your finger. It may be described as "weak" or "strong." A "thready" pulse is a weak pulse. A "full" pulse is a strong pulse. Rhythm includes the spacing and the force of the succeeding beats. If intervals between beats are of different lengths or if the beats are of unequal force, the condition is described as *arrhythmia.* In some individuals, this is a normal condition, but the symptom frequently indicates a serious condition and should be reported at once. Any marked change in the

pulse rate should also be reported immediately as it is usually a danger signal, especially following an operation or an injury. When the pulse becomes progessively weaker (thready) it is an indication of great danger and especially so when there is an accompanying change in rate and rhythm.

398. Counting Respiration

In taking respiration, three factors should be observed: the rate, the character, and the rhythm. Each is a significant indicator of the patient's condition. The normal number of respiration cycles per minute for the average adult is 14 to 20 per minute, but many conditions may influence this rate. As a person can consciously control respiration, to a limited degree, you should observe his respiration when he is unaware of it, if possible. The patient should be at rest, as when having the pulse taken. One method of counting respiration is to leave your fingers on his wrist as though still counting his pulse and watch the rise and fall of his chest or upper abdomen. Another method is to allow the patient's arm to rest lightly on the lower thorax, when you are counting his pulse, so that you can feel the rise and fall of the chest and abdomen. If a patient's breathing is noisy, you may count it by listening, but you will not be able to observe depth of respiration in this manner. Count for 1 minute. Besides counting the respiration observe its character. Is it shallow or deep? Is it rhythmical? What position does the patient instinctively assume? For example, when respiration is difficult, he may sit up to relieve the breathing; if the expansion of one lung is painful, he may lie on the affected side to splint it; if he has abdominal pain, he may hold the abdomen rigid and take only rapid, shallow breaths. Observe also the patient's skin color; dyspnea may be accompanied by cyanosis, causing a bluish cast around the lips and extremities. Always report any abnormal findings at once. Abnormal types of respiration frequently encountered are *dyspnea*, and *Cheyne-Stokes* breathing (fig. 116). *Dyspnea* is labored breathing. *Cheyne-Stokes* breathing is an irregular type of breathing, first very shallow, becoming progressively deeper, then progressively shallow again, and finally ceasing altogether for a brief period. The cycle is repeated over and over and is usually a sign of approaching death. *Apnea* is absence of breathing. In apnea a patient may go for 30 or 60 seconds without breathing. It occurs when there is an increase of oxygen in the blood and a decrease in carbon dioxide, which stimulates the respiratory center.

Figure 116. Diagram of Cheyne-Stokes respiration.

399. Taking Blood Pressure

a. General. Refer to paragraph 85 for definitions and descriptions of blood pressure, systolic pressure, diastolic pressure, and pulse pressure. Blood pressure (B/P) is written as a fraction, with the systolic on top; for example, 120/80. As blood pressure indicates immediately the patient's condition, it is often used by the medical officer in diagnosis and may influence the treatment he orders. *It is of utmost importance that blood pressure be taken and recorded accurately.* Any variation from the normal must be specially reported.

b. The Sphygmomanometer. Blood pressure is measured indirectly by the sphygmomanometer (fig. 117) and a stethoscope. Taking the pressure directly would mean opening an artery. The sphygmomanometer works on an *indirect* principle. A rubber cuff is wrapped around the arm and inflated with air. When the air pressure in the cuff equals the blood pressure, the arteries in the arm collapse. The air pressure is measured at this point, and, because the two must be equal, the blood pressure is found.

c. Method of Taking Blood Pressure (fig. 118).

(1) Have the patient in either a sitting or lying down position.

(2) Expose the upper arm and remove any restricting clothing.

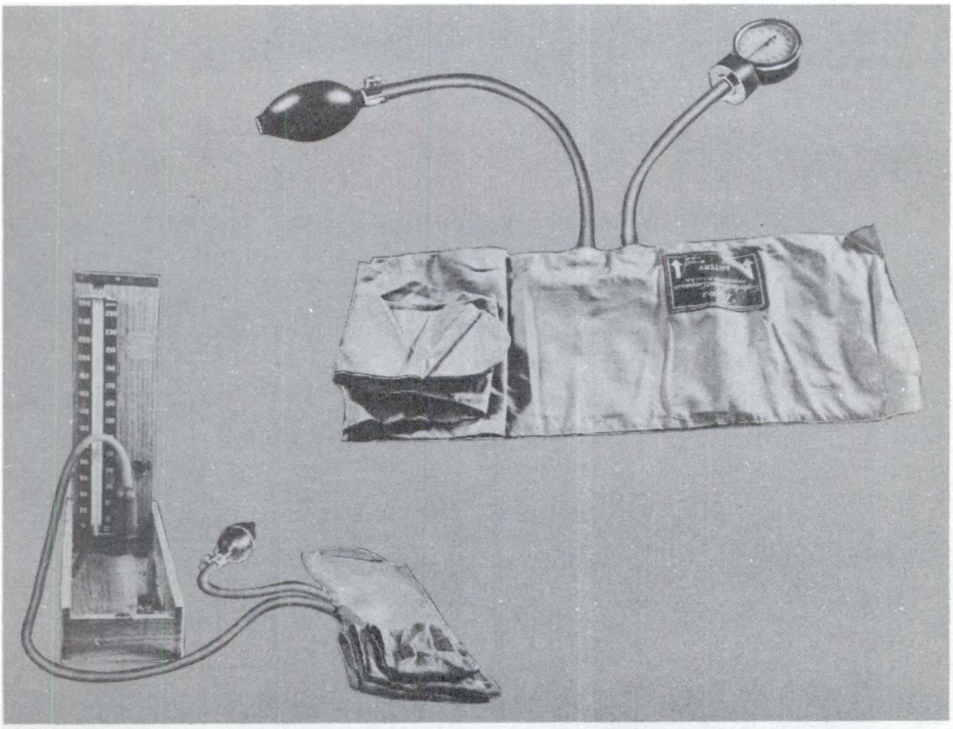


Figure 117. Sphygmomanometers. Instrument on left measures pressure by mercury; instrument on right is aneroid sphygmomanometer.

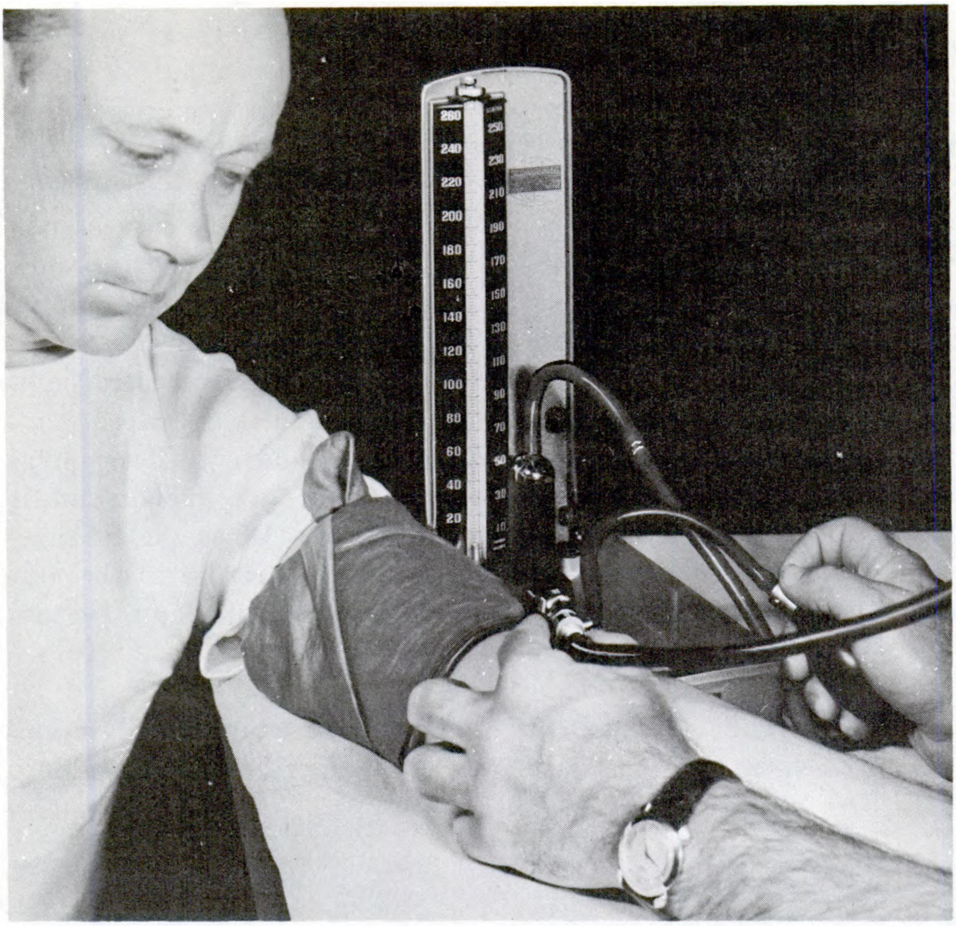


Figure 118. Taking blood pressure.

(3) Place the rubber bladder against the inner surface of the upper arm and wind the cloth cuff about the arm smoothly and firmly, but not tightly, binding the bladder in place.
(4) Locate the brachial artery by feeling with the finger tips. Place the stethoscope over the brachial artery.
(5) Close the screw valve on the rubber bulb by turning the screw clockwise, and inflate the cuff by pumping the bulb. Pump enough air into the bladder to collapse the brachial artery. (This will probably be 150 mm.; however, if sounds can be heard at this point, you must pump in more air until no sound is heard.)
(6) Allow air to escape slowly from the bladder by opening the screw valve on the bulb. (Turn screw counter clockwise.) At the same time, watch the column of mercury dropping in its tube. Suddenly you will hear through the stethoscope a clear sound, which means that the blood has just started to come back through the artery. This occurs when the heart contracts, forcing the blood through the arteries. The blood

pressure is at its highest peak. This is the *systolic* pressure. At this point make a reading of the level of the mercury column in its tube.

(7) Allow the air to continue to escape slowly, while you listen to the sounds and watch the fall of the mercury in the tube. When you hear the last distinct sound, take a second reading of the level of mercury. This is when the heart is relaxing and the pressure in the artery is at its lowest point. It is called the *diastolic* pressure.

(8) If an aneroid sphygmomanometer is used, the dial is clipped onto the cuff and readings are made as indicated by the needle (fig. 119).

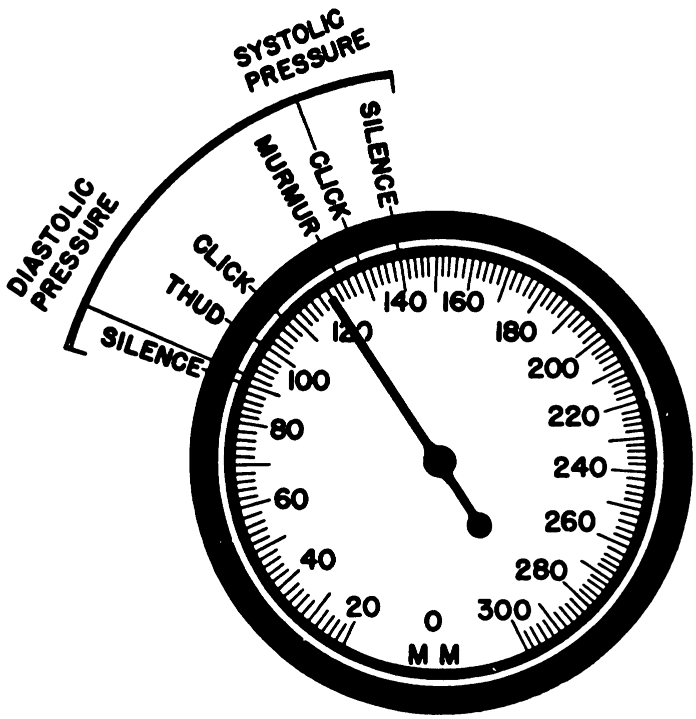


Figure 119. Dial of aneroid sphygmomanometer. Blood pressure illustrated is read 130/92.

Section VII. OBSERVATION OF PATIENTS

400. Signs and Symptoms of Disease

a. Signs. A sign is anything that can be detected about a patient's condition with one of the five senses (sight, hearing, touch, taste, or smell); that is, a swollen area of skin may be seen; the way a patient breathes may be heard; the ends of a broken bone grate together and may be felt; the odor of a patient's breath may be smelled.

b. Symptoms. Symptoms are any evidence of a patient's condition indicative of some bodily or mental state (for example, pain, nausea, headache).

401. Observation of Signs and Symptoms

The observation of signs and symptoms is part of the specialist's duties. You must observe your patients when you walk through the ward, give a bed bath, administer a hypodermic, or carry out any of your duties. This observation is important because a specialist is with the patient the greater part of the day, while the medical officer or nurse may see the patient for only a few minutes two or three times each day. It is the responsibility of the specialist to determine any change in the patient's condition and to report it to the nurse or medical officer. The medical officer must depend upon the nurse and the specialist to inform him of everything that takes place in his absence. They must obtain and impart information which will be of the greatest value in diagnosis and treatment. Not only must you cultivate the habit of observing signs and symptoms, but you must learn to attach to them their relative importance. Emergencies continually arise when you must determine what is to be done and whether the signs or symptoms are of sufficient gravity for you to send for the nurse or ward officer.

402. Training and Developing Power of Observation

To increase your skill in observing the patient's condition, you should (1) increase your background knowledge, (2) take an interest in the patient and develop a sympathetic understanding of the whole patient, and (3) strive to be attentive and accurate as well as being a good listener. Increase your knowledge by conscientious and accurate use of all your senses and by accumulating a fund of information (from books and from leaders in the patient care team) concerning what symptoms to expect in certain conditions. Give attentive interest when the patient tells you how he feels. Question him carefully so that you can make a complete report of the symptoms he tells you about. Try to anticipate the patient's emotional and physical needs and discomforts; do what you can to relieve him. Be accurate and conscientious in your performance of procedures which determine signs of illness, such as taking the pulse, measuring output, and taking blood pressure.

403. System for Observation of the Patient

As you observe the patient and as you question him concerning how he feels, consider his general appearance, the functioning of his body systems, and the state of his consciousness. When reporting his symptoms always identify the patient by name, rank, ward number, and ward; give the time of the onset of the symptoms, the duration, location and area, and a complete and accurate description. Table X may assist you in observing the patient systematically.

Table X. Guide for Observation of the Patient

1. GENERAL APPEARANCE.

	Check List				
a. Stature	short	tall	missing limbs.		
b. Body build	thin	emaciated	well-nourished.	fat	
c. Posture or position in bed	comfortable	relaxed			
d. Skin	pale	flushed	cyanotic	dry	moist
e. Lips	cracked	swollen	lesions	trembling	cyanotic
f. Eyes:					
Whites	red	yellow			
Pupils	dilated	contracted	unequal		
Lids	edematous	discolored			
g. Facial Expression:					
Physical	fatigue	pain	drowsiness		
Mental	worry	alarm	sadness	anger	

2. BODY FUNCTIONS:

	Check List				
a. Digestive System:					
Complaint of patient	nausea	no appetite			
Vomitus	undigested food.	coffee ground.	bile colored (green).		
Feces (consistency)	liquid	tarry	constipated		
Feces (color)	green	black	clay-colored		
Feces	parasites				
b. Circulatory System:					
Hemorrhage	oozing	spurting	amount		
Pulse	rate	irregular	thready	bounding	imperceptible.
c. Respiratory System:					
Respirations	dyspneic	irregular	wheezing	crowing	
Cough	productive	nonproductive.	hacking		
Sputum	tenacious	frothy	copious	rusty	foul
d. Genitourinary:					
Urination	dysuria	frequency	burning		
Urine	amber colored.	bloody	brown		
e. Special Senses:					
Speech	meaningless	unintelligible.			
Hearing	ringing in ears	tenderness	pain	dizziness	
Loss of sensation	numbness	tingling			
Vision	blurred	double			

3. STATE OF CONSCIOUSNESS (Observe depth and duration):

	Check List				
a. Coma, Comatose	(patient cannot be aroused)				
b. Stupor	(patient can be aroused with difficulty)				
c. Sensivity to stimuli.					
d. Disorientation to	time	place	people		

Table X. Guide for Observation of the Patient—Continued

4. MENTAL CONDITION:

	Check List				
a. Behavior	belligerent	uncooperative.	aggressive	withdrawn	irritable alert.
b. Emotions	depressed	fearful	anxious	apprehensive.	

Section VIII. MAINTAINING A FLUID BALANCE RECORD

404. The Importance of Fluid Balance

For patients with certain diseases or injuries, the doctor may order that a fluid balance record be kept. The medical specialist is frequently asked to assist in keeping this record. The fluid balance record must be kept as accurately as possible, as it frequently is an important clue to the patient's progress. In a healthy person the fluid in the tissues is maintained and regulated naturally. The intake keeps pace with the output. Under certain circumstances, however, this fluid balance is upset causing what is known as positive water balance (more intake than output) or the reverse condition—negative water balance. Water constitutes 59 to 63 percent of the body weight. Daily water intake of the average person is about 2,500 cc. The same amount is normally eliminated through the kidneys (in urine), through the skin (in perspiration), through the lungs (in evaporation), and from the large intestine (in moist feces). In cases of injury or disease, other means of intake and output, discussed later in this section, must be taken into consideration. If the output of water is greater than the intake, dehydration results; if the output is less than the intake, a condition known as "edema" results. "Edema" is a condition in which fluid escapes into the tissues, causing swelling.

405. The Fluid Balance Record

The fluid balance intake and output record is a 24-hour worksheet on which members of the patient care team record all fluid taken in and put out by the patient. This worksheet (DD 792) provides spaces in which to record the time, the type, the description, and the amount of intake and output.

406. Intake

Intake consists of all liquid taken into the body of the patient. The means of intake may be oral, intravenous, rectal, or by hypodermoclysis or gavage. Fluid taken in by any of these means must be taken into account, measured as accurately as possible, and recorded.

407. Output

Output consists of all liquid released by the body of the patient. Output is by means of voiding, vomiting, drainage, catheterization, perspiration, and defecation. Urine must be measured each time the patient urinates or is catheterized; drainage and vomitus estimated as accurately as possible; and a notation must be made of feces (whether soft or hard).

408. Responsibilities of the Medical Specialist

As a medical specialist you may be asked to assist in keeping the fluid balance record. It may be your duty to "force" or restrict fluids taken orally by the patient according to the doctor's orders. It will be of help to you if you know the approximate amounts that certain drinking utensils hold; for example, a water glass or a cup holds about 8 ounces or 240 cubic centimeters. Record the intake each time on the worksheet. Measure all urine before emptying the urinal, and record the amount. At the end of the 24 hours, the nurse totals the amounts and inserts them on the intake and output record. You may also be called upon to assist the nurse or doctor with intravenous fluids, with tube feedings, or with emptying and measuring drainage bottles.

Section IX. WARD PREPARATION OF PATIENTS TO BE SENT TO CLINICS, LABORATORIES, OR THE OPERATING ROOM

409. General Rules

Procedures vary from one hospital to another concerning ward preparation of patients who are to be sent or escorted to clinics, laboratories, X-ray, or to the operating room. These various departments set up their own standard operating procedure and issue a set of instructions to the ward. These general instructions and the doctor's orders for the particular patient must be checked and carried out carefully to insure the best results for the patient. A few general rules which you should remember are the following:

a. Mental Preparation of the Patient. Tell the patient what to expect and explain his role in the preparation. Mental preparation of the patient gives him emotional security and gains his confidence and cooperation.

b. Prepare the Patient Physically. Have the patient clean, properly dressed, and protected from exposure or drafts. Make sure that any specific preparation ordered has been accomplished; such as a cleansing enema, medication, rest for a required period, food or liquids restricted, etc.

c. Have the Patient in the Right Place at the Right Time. If he is an ambulatory patient, give him specific directions as to how to

reach the clinic or laboratory (a patient going to surgery is always escorted). If he is not ambulatory, provide suitable transportation for him. Accompany him or make sure that someone else is accompanying him. Be sure to have the right patient. Get him there on time. For getting a patient into a wheel chair see paragraph 390*d;* for placing him on a litter see paragraph 410*b*.

d. Take Patient's Chart and History to the Clinic or Operating Room for Reference. Never allow the patient to carry his chart himself or to read it. Be sure that the results of the test or procedure are recorded on his chart.

410. Ward Preparation for Surgery

a. When a patient is listed for an operation, the operative area is usually prepared and shaved the day before the operation by an operating room specialist who is sent to the ward from surgery. In emergencies, however, this preparation may be done by a corpsman on the ward. If you are asked to shave a patient for an operation, proceed very carefully in order to avoid all nicks and scratches. Every nick and scratch provides an entrance for infection. The skin is scrubbed with bactericidal soap after the shave. See that urine and blood counts are reported back by the laboratory and that the patient's chart is complete. Make sure that the patient has deposited his money and valuables. The night before the operation, give an enema, if it is ordered. Diet and fluids are usually restricted. The patient usually takes or is given a bath on the morning of the operation, but orders vary according to his condition. If the operation is scheduled for a very early hour, the bath may be ordered for the evening before. See that his teeth are clean and his hair combed. All prosthetic appliances must be removed before surgery; wedding rings, and medals may be taped on. Preoperative medication is given by the nurse according to doctor's orders. The order is always written by the medical officer in the order book. The ward officer prepares a preoperative examination report, which is taken with the patient to the operating room. The patient is taken to the operating room either in his bed or on a litter.

b. Moving a Patient to a Litter.

(1) If the patient can help himself, place the litter alongside the bed. Standing on the free side of the bed and reaching across it, place your arms under the patient's shoulders and thighs to assist him onto the litter. Keep the litter steady.

(2) If the patient must be lifted, place the litter at a right angle to the bed, with the head of the litter to the foot of the bed. Three helpers stand on the same side of the bed as the litter. One helper places a hand under the patient's head and slides it to the opposite shoulder so that

the head rests in the bend of the helper's elbow. The other hand is placed under the shoulders. The second helper puts both hands, palm up, under the hips. The third puts one hand under the thighs and the other under the calves of the legs. They draw the patient to the edge of the bed, tilting him slightly toward them, lift him from the bed, turn toward the litter and carefully place him on it.

(3) When the patient has been placed on the litter, cover him. *Fasten straps.*

Section X. POSTOPERATIVE CARE OF THE PATIENT

411. The Surgical Recovery Unit

a. Purpose and Importance. The Surgical Recovery Unit, located adjacent to the Operating Room, is closely related to it, but functions as a separate unit. Staffed with specially trained personnel, this unit frees the wards from the exacting burden of caring for the patient who has received general or spinal anesthesia, at the same time they must carry on the regular ward duties. The patient is kept in the Recovery Room until he reacts fully from the anesthetic, at which time he may be transferred to a regular ward. The Recovery Room is arranged so that the patient can be under constant observation. A specialist will usually be designated for one or more particular patients. It is his duty to stay with them and observe them continuously for any unusual symptoms, which he must report at once to the nurse in charge.

b. Preparation for the Patient.

(1) The equipment of the Recovery Room includes all types of apparatus, sets, and supplies which might be needed to care for a postsurgery patient. The room should be quiet, moderately warm (68°–70° F.), and well ventilated, but not drafty. The bed is a regular hospital bed, but is usually equipped with bed rails, which may be lowered or raised as needed. There are many variations of the "ether" or "anesthetic" bed, but the underlying principles are the same for preparing all of them (par. 372).

(2) In the immediate area of the patient, have ready for use the following equipment: sphygmomanometer, portable suction apparatus, mouth wedge, emesis basin, tissue wipes, pad, and pencil.

(3) Additional equipment which may be needed and which should be available on the ward for use are oxygen apparatus and oxygen, airway, tracheotomy set, dressing tray, and stimulant tray. Most hospitals also keep in readiness respirators, cardiac arrest packs and equipment, equipment for infusion and transfusion, and shock blocks.

412. Reception of the Patient in the Recovery Room

a. Knowledge of Type of Operation and Anesthesia. The recovery room nurse checks the operating room schedule so that she can prepare ahead for the reception of each postsurgery patient and have in readiness the special equipment needed for the case. She will note the type of operation and the anesthetic used, as this will determine several factors in caring for the patient. When the patient is brought in from the Operating Room, she rechecks the operating record, as variations in the proposed operation or anesthesia have sometimes occurred. She also checks with the anesthetist on how the patient got along during the operation.

b. Transfer of Patient to Bed. The anesthetist accompanies the patient from the Operating Room to the Recovery Room, helps to transfer him from the litter to his bed, positions him, and gives the recovery room nurse a verbal report on the patient's general condition. At least three people and preferably four are needed to transfer the patient: one (usually the anesthetist) at the patient's head, one at his feet, and one on each side to grasp the drawsheet. Accomplish the transfer with as little jarring as possible to avoid overtaxing his circulatory system. Prevent undue strain on the operative area. Keep his body straight and support his extremities and head. Be careful not to dislodge any tubing; transfer the bottle of infusion from standard on litter to standard by the bed. The nurse will help the anesthetist arrange the patient's position. After the patient is on the bed, remove his cap worn in the Operating Room. Tuck in top covering. Be careful not cover him too much. A postoperative patient usually does not require any more covering than an ordinary patient. Excess cover will cause profuse perspiration and a consequent loss of fluid which imposes a burden on the circulatory system.

c. Position of Patient. The position of the patient varies with the operation. Unless contraindicated, however, place a patient on his side until his swallowing and gag reflexes return. Flex his knees slightly to prevent strain and place a pillow at his back for support. Turn his face to the side and extend his chin. This allows his tongue to come forward and facilitates respiration. It is dangerous to place him on his back as he may aspirate mucus or vomitus into the bronchi, or his breathing may be obstructed if his relaxed tongue falls back into the throat. If for some reason he must be placed on his back, turn his head to the side when he vomits; use suction when required, and watch him carefully to prevent respiratory obstruction.

413. Immediate Care

a. Checking Postoperative Orders. The nurse in charge of the ward checks the postoperative orders and sees that they are carried out. The specialist can be of greater assistance with the patient he is caring for, if he too notes the orders.

b. Care of Drainage Tubing and Intravenous Apparatus. Locate and check all tubing as soon as the patient is positioned and check it frequently thereafter. Be sure that all tubing is open and free of kinks. Note the amount and character of drainage. Watch the speed of the intravenous infusion.

c. Prevention of Respiratory Obstruction. An artificial airway is frequently inserted in the mouth of an anesthetized patient to hold the tongue forward and prevent what is commonly called "swallowing the tongue." If this is used, remove the airway when the patient begins to gag. In removing the airway, follow the curve of the airway to avoid injuring the mouth or throat. Gagging indicates that his swallowing reflexes are returning. Should the patient's tongue fall back in his throat, press on the angle of the lower jaw and push it forward, keeping his teeth separated. You may be able to grasp his tongue with a gauze square and pull it forward. Sometimes a mouth wedge can be used effectively to prevent the tongue from falling back. An improvised mouth wedge may be made by wrapping gauze around several layers of wooden tongue blades. If the patient's breathing is noisy, it may indicate respiratory obstruction. Use suction. To suction mucus or vomitus, attach a whistle-tip catheter to a portable suction machine, and plug in machine to an electric socket. Insert the tube through the mouth or nostril. Pinch off the catheter during insertion to prevent damage to nasal mucosa. Leave the catheter in place only long enough to suction off secretions. If the tube comes clogged, remove it and suction some water through it until it is cleared. This need not be sterile water as the throat and nose are not considered sterile.

d. Checking Dressing. Hemorrhage is a constant danger during the first 24 hours. Observe the dressing at frequent intervals and note the character and amount of drainage. Inspect the area underneath the patient to be sure bleeding is not taking place. Sometimes the top layer of a dressing will be clean and dry, but the patient will be lying in a pool of blood which has oozed from the side or underneath the dressing.

e. Checking Vital Signs. Check blood pressure, pulse, and respiration when the patient is admitted and every 15 minutes until the anesthetist gives an anesthesia clearance. Any marked variation from the normal must be reported at once to the nurse. Excessive increase in pulse or weakness in its volume may indicate shock or hemorrhage. Respiration should be uniform (12 to 24 per minute). A high squeaky respiration or an unusually noisy one should be reported at once as it may indicate respiratory difficulty. Watch depth of respiration as well as rate. Take the patient's temperature every four hours during the first 24 hours. Observe the color and condition of the patient's skin. Report excessive moisture or dryness, pallor, cyanosis, or flushing.

414. Care After Patient Reacts

a. General Comfort Measures. Most patients will go through several stages of recovery. At first they become restless and seem to be in a state of mental confusion. It is a peculiar thing, but the faculty of hearing seems to return first. Therefore, be exceptionally careful about what you say where the patient can hear you and about noise which might disturb him. Reassure him. Speak in a low, calm voice as you stand near his head. Tell him the operation is over and that he is going to be all right now. Call him by name. He will usually rouse momentarily, say a word or two and then go back to sleep. Watch him very carefully at this state, especially if he has had a general anesthetic, as he may vomit. Change his position every hour (unless contraindicated) to insure good expansion of the lungs and prevent postoperative pulmonary complications. Check drainage tubes. When he is fully conscious, he may lie on his back and have his head elevated a little unless the doctor has left orders that he lie flat.

b. Common Postoperative Conditions.

(1) *Nausea.* Nausea and vomiting occur following some anesthetics. Fluids by mouth are restricted until the nausea has disappeared. As soon as the patient seems to have finished vomiting, wipe off his face with a damp towel and allow him to rinse his mouth with plain water or mouth wash. As soon as feasible give him a sponge bath, rub his back with alcohol, and put clean pajamas on him.

(2) *Abdominal distention.* If there is considerable abdominal distention and it is painful, the doctor may order a warm enema or give an injection to cause expulsion of the accumulated gas. In some cases he may insert a Miller-Abbott tube or a Levin tube (pars. 440 and 447). If this procedure is indicated, have equipment ready. Although flatus (gas) may be expelled earlier, a spontaneous bowel movement usually does not occur until about the fourth or fifth day following surgery. This is due to a temporary paralysis of the gastrointestinal tract because of anesthesia and to the lack of bulk in the intestines. Some surgeons prescribe an enema. Frequent change in position and early ambulation, if possible, are beneficial in preventing gas pains.

(3) *Urinary retention.* Following surgery, the bladder tends to hold urine which has been accumulating for a longer period of time than usual. Urine allowed to accumulate without release at normal intervals, will cause urinary retention, which is sometimes very painful. Besides the discomfort, it may also cause bladder infection. Most surgeons

make provision for catheterization of the patient who is unable to void within 8 to 10 hours following an operation.

(4) *Pain.* The most common complaint of the patient immediately following surgery is pain at the site of the operation. The doctor usually leaves orders for medication in case of pain. This medication usually consists of some narcotic, but other types of medication also are sometimes ordered. Medication for pain is usually given before the patient is intensely uncomfortable so that he will be able to relax quickly and rest. Dosage indicated on orders is usually reduced until after anesthesia clearance. Sometimes pain is due to hard rubber drains, or too snug a binder, or to an uncomfortable position in bed. Investigate these causes and alleviate them when possible. Medication is always given by the nurse or under her direct supervision.

c. Observation of Patient. Continuous observation is essential even after the patient reacts from the anesthetic, because there are many accidents or complications which might occur. Be alert to observe any irregularities in temperature, pulse, blood pressure, respiration, or color of skin. Keep a constant watch to make sure that the drainage tubes are functioning properly. Listen to the patient's complaints and do not overlook their significance and the importance of reporting them to the nurse or doctor, who are trained to evaluate them.

d. Fluids and Diets. The patient may usually be given small amounts of water after he reacts from the anesthesia. If orders are given that he have nothing by mouth, wipe off his mouth with a damp gauze sponge as his lips may feel very dry. You may also give him some cracked ice wrapped in gauze to hold against his mouth. After his vomiting has ceased, he can ordinarily tolerate food. The fluids and diet for each patient are ordered by the surgeon. Unless contraindicated, encourage the patient to drink water or other fluids. This is beneficial in maintaining the proper fluid balance in the body and in preventing shock. Because of fluid loss in some cases, the doctor may order parenteral feedings and solutions. These also tend to decrease thirst. An accurate record must be kept of intake and output. Output includes urine, vomitus, feces, and drainage from any body area. Sometimes a separate intake and output chart is kept on very ill patients, but the totals are reported in the notations usually made on the nurse's notes.

e. General Nursing Care.

(1) General nursing care of the postoperative patient parallels that for the regular patient in many respects. Mouth hygiene, baths, and back rubs contribute to his comfort and recovery. During his first 24 to 36 hours, however, remember that he needs rest more than anything else after the

mental and physical strain of the operation. Limit his hygiene care to absolute necessities and perform this with a minimum of confusion.

(2) The postoperative patient perspires profusely and should be given a sponge bath as soon as his general condition permits. This may be followed by an alcohol rub. Do not rub the limbs, as this might dislodge a thrombus and result in embolism, causing death. Give special care to the mouth, offering the patient a mouth wash frequently and as soon as he can tolerate such details, brush his teeth for him if he is not able to do so.

(3) Watch the patient's position in bed. Poor body alinement in a surgical patient can result in complications, such as pulmonary complications, faulty drainage, urinary and gastrointestinal difficulties, and impairment of circulation. (Refer to paragraph 389 for details of positioning the patient for comfort and good body alinement.) Change the patient's position frequently, if he is not able to do so himself. Encourage him to move about as soon as he is able. Early ambulation is desirable in most postoperative cases.

415. Postoperative Complications

a. General Conditions. There are several types of complications which may occur postoperatively.

(1) *Shock.* Shock is caused by blood loss, plasma loss, dilation of the peripheral blood vessels caused by spinal anesthesia, operations on the sympathetic nervous system, or severe emotional trauma. Regardless of its cause, shock must be recognized and treated immediately. A lowered blood pressure and a weak, rapid pulse are two of the most important signs. Apathy, pallor, and moist, cold skin are also indicators. The temperature may be subnormal and the respiration abnormal. While complete treatment depends upon the underlying cause, emergency measures can be taken by the specialist until the doctor or nurse can be summoned. One of the quickest and easiest methods to combat shock is to elevate the foot of the bed. This method assists venous return by gravity. Patients with head injuries, however, must remain horizontal and therefore will probably need a blood transfusion or an intravenous solution of plasma. Get this equipment ready. Do not turn the patient or raise his head as his circulation is very unstable. Keep the patient warm but do not overheat him; this would result in fluid loss through perspiration. Report shock at once and stay with the patient.

(2) *Hemorrhage.* During the operation primary bleeding usually occurs. This is a steady oozing from capillaries or from the small blood vessels which were not tied off. Reactionary bleeding or secondary bleeding occurs within a few hours after the operation when circulation and blood pressure return to normal. Owing to the depressing effect of the anesthetic on the circulation, bleeding from capillaries may be very slight during the operation, but increase considerably as the effect of the anesthetic wears off and the heart beat becomes stronger. This increased blood pressure may also cause bleeding from veins overlooked by the surgeon, or it may displace blood clots previously formed. In some cases it may even cause a ligature to slip, causing bleeding to occur from a large vessel. Realization of this danger and its cause is of utmost importance. If the hemorrhage occurs externally, a careful inspection of the dressing will reveal its presence. Do not attempt to remove the dressing; reinforce it and call the nurse. If hemorrhage occurs internally, as when a wound is tightly packed with no means of drainage, the blood will flow into the tissues or into a body cavity. This will cause systemic symptoms and perhaps shock. Keen observation is necessary to detect internal bleeding. Restlessness, apprehension, rapid pulse, weakness, and thirst are all symptoms which should alert the specialist to the possibility of internal hemorrhage. Report any of these abnormalities at once. If bleeding is severe, the patient's life is in danger.

b. Respiratory Complications. Atelectasis, or lung collapse, usually occurs when incomplete aeration of the lungs cause a mucus plug which closes one of the bronchi. The pulmonary tissue beyond the plug collapses. Deep breathing and coughing may be used to dislodge the plug. The patient should be instructed how to breathe deeply by pulling in the abdominal muscles. Place your hand on his abdomen to make sure he is doing it correctly. Deep coughing should be encouraged. The incision can be supported by placing the hands on either side of the operative site and exerting firm pressure. Turning the patient from side to side each 2 hours also helps in aeration of the lung.

c. Circulatory Complications.

(1) Thrombophlebitis (or blot clot in the veins) sometimes occurs after an abdominal operation. It is very dangerous and must be recognized early and given special care. The first symptom is usually a pain or cramp in the leg. The patient must remain in bed until the doctor has examined him. Under no circumstances should the affected part be

rubbed. It is important to keep the leg at rest, as even a slight movement might dislodge the clot which would probably then be carried on to the heart, causing pulmonary embolism and death. Elevate the leg on soft pillows; prevent pressure of bedclothes by using a bed cradle if necessary.

(2) Pulmonary embolism is the obstruction of the pulmonary artery by a large blood clot. It occurs postoperatively or in cardiac disease and may result in sudden death. The patient has sharp, stabbing pains in the chest and is apprehensive and breathless. Place him in an upright position with proper support. Call the doctor. He may administer an opiate to quiet the patient and order oxygen to ease breathing.

d. Gastrointestinal Complications.

(1) A certain amount of nausea and vomiting usually follows general anesthesia; if this condition continues, however, the doctor may order certain sedatives, insert a tube into the gastrointestinal tract to put it at rest, or he may order parenteral feedings. Excessive vomiting causes dehydration and loss of electrolytes, a condition which causes further nausea and vomiting. Good nursing care can be of help here also. Nausea tends to increase with motion; therefore, change the patient's position very slowly and with extreme gentleness. Instruct the patient to breathe deeply. Keep his face clean and dry and support his head when he vomits. Reassure him.

(2) Acute dilation of the stomach and paralytic ileus sometimes occur when there is an accumulation of gas and fluid which the stomach and small intestine are unable to pass along. Almost immediate relief is obtained by intubation (accomplished by the doctor).

e. Disturbances of Metabolism. Disturbances of metabolism such as dehydration frequently follow surgery unless measures are taken to maintain proper fluid balance. The doctor may order parenteral solutions. Refer to section VIII for procedure in maintaining an intake and output record.

Section XI. APPLICATION OF HEAT AND COLD; THERAPEUTIC BATHS

416. General

Local or general applications of heat or cold are often used in caring for a patient. They are applied to relieve pain or discomfort, and to reduce swelling, inflammation, or fever. Some procedures make use of the contrasting effects of heat and cold which

are explained in the following paragraph. The results obtained in applying heat or cold depend upon many factors such as the condition of the patient, his age, weight, vitality, and individual reaction. Always have a doctor's order for all applications of heat and cold. The doctor will usually indicate the method, the area to be covered, the temperature of the application, and the duration and frequency of treatment. When either hot or cold applications are used, the patient reaction must be watched.

417. Effects of Heat and Cold

a. If heat is applied to an area of the body, the capillaries become dilated, the skin red, and the blood flow in the area greatly increased. The improved blood supply increases the local metabolism and speeds up the process of healing. By dilating the blood vessels heat causes the area to be supplied with additional nutritional elements, thus supporting and maintaining body tissue and stimulating the growth of new tissue. There is an increase in white cells, which ward off infection, combat disease organisms, and aid formation of pus. Heat hastens the absorption of waste products, relaxes muscles, and relieves stiffness. It stimulates also the excretion of waste products through the skin by increasing perspiration. It helps to maintain the normal body temperature in such conditions as shock, exposure to cold, and chills. It has a sedative effect on the central nervous system.

b. Cold, on the other hand, causes the blood vessels to contract and tends to reduce infection and edema. It reduces the pain of inflammation because it reduces the sensitivity of the nerve endings in the skin. It contracts the muscles, prevents or relieves swelling after an injury, reduces the body temperature, and has a sedative effect.

418. Local Application of Heat

a. Dry Heat. Dry heat may be applied locally by a hot water bottle, a chemical or electric pad, or a heat cradle.

(1) *Hot water bottle.* To prepare a hot water bottle, fill a pitcher with hot water (about 125° F.). Test the temperature with a bath thermometer or by pouring a small amount of water over the inner surface of the arm. Fill the hot water bottle one-third to one-half full. Expel the air by gradually resting the bottle flat on the table until the water reaches the neck. At this point secure the stopper, dry the bottle and test it for leaks. Apply a cloth cover.

(2) *Chemical heating pad.* The chemical heating pad comes complete with the stick and waterproof cover. Clear the opening in the upper corner of the pad with the small stick and pour in 30 cc. of cold water. Manipulate the bag briskly

between your hands to mix the water and chemicals. Place the bag in the water proof container and apply the pad to the patient as directed. The amount of heat which continues to be generated for several hours by chemical reaction cannot be controlled; therefore, you must check frequently to be sure the pad is not too hot for the patient. Apply additional covering over the pad if it is too hot.

(3) *Electric pad.* For applying dry heat over long periods of time, an electric pad is often used. Do not allow the pad to get wet. If it is being used with wet dressings, wrap it in an impermeable cover of rubber or oiled silk.

(4) *Heat cradle.* A heat cradle is a method of applying dry heat to an extremity when it is desired not to have the bed clothes and weight of a hot water bottle on the part treated. It consists of a framework (par. 390*a*) with 20-watt electric light bulbs attached to sockets within it. Some heat cradles have a thermostat which automatically controls the temperature; otherwise, you must maintain a careful watch to prevent excess heating. Control the heat by turning the bulbs on and off.

b. Moist Heat.

(1) *The local hot water bath.* The local hot water bath is a frequently used method of applying moist heat. Two of the most common hot water baths are an arm or foot bath, and the Sitz bath. Follow the doctor's orders carefully with special attention to the temperature of the water and the length of time. Use a thermometer to test the temperature. Be very careful not to burn the patient. Place the patient in a comfortable position with his body well-supported. A foot bath may be given with the patient sitting comfortably in a chair, or in a bed. Protect the upper part of his body from cold by wrapping a blanket around him. Use another blanket to cover the legs. Apply cold to the head. Avoid exposure to cold when removing the patient from the bath. The Sitz bath is usually given to reduce inflammation of the rectum or following a hemorrhoidectomy. This bath, in which the buttocks and pubic region are immersed in water with the patient in a sitting position, is sometimes given in a special tub in which the patient may sit in the water and have his feet outside. If this tub is not available, the bath can be given in an ordinary bathtub. Apply cold compresses to his head while he is in the bath. The prescribed temperature for this bath is usually 110° F. to 120° F., depending upon the patient. The heat may be increased gradually to 120° F. but must never ex-

ceed this. Elderly people and small children require slightly lower temperatures.

(2) *The massive wet dressing (nonsterile procedure).* This method is used to apply hot packs to large areas such as an entire arm or leg. It is particularly valuable in the treatment of infections of the arms or legs. It consists of wrapping the entire region in bath towels or flannel wrung out in hot water or magnesium sulfate solution. Use a rubber sheet to keep the bed dry. Hot water bottles in the pack help keep it hot.

(*a*) *Equipment.*

1. Towel or small sheet to use as binder.
2. Hot water bottles.
3. Rubber sheet.
4. Bath towels.
5. Large basin for solution.
6. Lubricant for the skin.

(*b*) *Procedure.*

1. The solution to be used should be as hot as the hands can comfortably stand.
2. Fill hot water bottles. Lubricate the skin area over which the dressing is applied.
3. Place two bath towels in the basin. Wring out the towels as dry as possible, and place one under and one over the area to be treated. Before leaving the towels in place, test against patient's skin to be sure that the towel is not hot enough to burn him. Place hot water bottles on either side of the part being treated and wrap the rubber sheet around the entire dressing. Pin the binding cloth in place so that the dressing will not slip.
4. Change the towel every 1 or 2 hours.

419. General Application of Heat

Hot baths are often used in the treatment of inflammatory conditions of the joints and nerves, such as arthritis and neuritis. Hot baths may be dangerous and are usually given only in a hydrotherapy department under the direction of experts. Should you be directed to give the patient a hot bath, note his pulse, breathing, color, symptoms of excitement, or signs of cerebral congestion such as headache, nausea, vertigo. If signs of cerebral congestion occur, apply at once an icecap or a cold compress to the head. Except in edematous conditions, encourage copious drinking of water before and during the bath. The temperature of the water may vary and may be gradually increased, but should never be above 110° F. The patient remains in the bath from 2 to 30 minutes and should lie down afterwards for at least an hour. Prevent chilling of the patient.

420. Local Application of Cold

a. Dry Cold. Dry cold, applied by means of an ice collar or an icecap, is frequently ordered for constriction of blood vessels (as after a tonsillectomy) or for reducing swelling (as in a sprained ankle). This type of cold can be tolerated for longer periods than moist cold. In preparing either the icecap or the ice collar, always fill it about half full of ice and expel the air before closing the cap. Test for leakage. Cover with a cloth or a bag and apply to the area to be treated. Refill with ice as often as necessary. Observe the skin under the icecap or collar carefully every hour and report blueness or mottling immediately.

b. Moist Cold. Moist cold, more penetrating in its action, may be applied in the form of cold, wet compresses. This treatment is frequently used for a patient who has inflammation in a limb, but no drainage from it. Protect the bedding and place the patient in a comfortable position before you start the treatment. Wring the cold compress from the water containing ice and apply it as quickly as possible. Do not cover the compress.

421. General Application of Cold

a. Tepid Sponge Baths.

(1) *Purpose.* Tepid sponge baths are given to relieve fever or high temperature and to stimulate circulation. If they are used to reduce fever, they must be continued over a period of time.

(2) *Equipment.* Before beginning the bath, be sure that the room is warm and bring all the following supplies to the patient's unit:

(*a*) Icecap or cold compresses.
(*b*) Rubber treatment sheet.
(*c*) Sheets, 2.
(*d*) Bath towel.
(*e*) Bath pan with tepid water (65° to 90° F.) or cool (40° to 75° F.).

(3) *Procedure.*

(*a*) Assemble the equipment. Screen the patient if he is in an open ward. Fold top covers to the foot of the bed. Cover the patient with a large sheet and place the second sheet and treatment sheet beneath him. The top sheet may be removed during the bath leaving only the loins draped, or it may be left on and drawn back to expose only the part being treated.
(*b*) Place an icecap or cold compress on head.
(*c*) With wash cloths apply water to the face, the front of the body, and the arms. Treat the legs next. This part of the treatment should last 3 minutes.

(*d*) Turn the patient and bathe the back beginning at the neck and working downward. This should continue for 7 minutes.

(*e*) During the treatment observe the color and pulse of the patient. If there is any indication of unfavorable reaction, discontinue treatment immediately and report the condition to the medical officer or nurse.

(*f*) When the bath is completed, cover the patient with a sheet. Dry him gently, using very little friction. Remove the rubber treatment sheet.

(*g*) Replace pajamas, pillow, and top covers.

(*h*) Clean the equipment and dispose of used linen.

(*i*) Record the treatment and the patient's reaction.

b. Alcohol Sponge Bath.

(1) *Purpose.* The alcohol sponge bath is given for the same purpose as the tepid or cool sponge. It is used when the patient is to be disturbed as little as possible. Since alcohol evaporates at a lower temperature than water, the parts being sponged dry more quickly, the patient's reaction is less marked, and the bedding is not so likely to become wet.

(2) *Equipment.*

(*a*) Alcohol, 50 to 70 percent.

(*b*) Bath towels, 2.

(*c*) Sheet.

(3) *Procedure.*

(*a*) The alcohol sponge bath is given in the same manner as a tepid or cool sponge, except that a small amount of alcohol is used instead of water. Bath towels are used to protect the bed.

(*b*) Wet the skin with alcohol and then allow the alcohol to evaporate.

(*c*) Record the treatment and the patient's reaction.

Section XII. STERILIZATION OF SUPPLIES

422. General

An object is *sterile* when it is free from all microorganisms. Destruction of these microorganisms is called *sterilization* and is accomplished by heat (moist heat in the autoclave or dry heat by burning or flaming). *Disinfection* may be accomplished by other means (par. 502). The chief difference between sterilization and disinfection is that sterilization kills all microorganisms including the spores, while disinfection may not destroy the spores. For this reason, all objects coming in contact with a patient's open wound must be sterilized.

423. Microorganisms

a. Classification. Microorganisms are living plants and animals too small to be seen singly except with the aid of the microscope, but they are visible to the naked eye when they form colonies or groups. They vary in size and shape and also in their effect on man. Microorganisms belonging to the animal kingdom are called protozoa; those belonging to the vegetable group are the bacteria, fungi (yeasts and molds), the rickettsia, the spirochetes, and the viruses. Protozoa cause such diseases as amoebic dysentery, African sleeping sickness, and malaria. Most infectious diseases of man are caused by bacteria or viruses. There are two general classes of microorganisms that cause infection: (1) those that can cause disease in a healthy person and are transmitted directly or indirectly from animals or persons ill of the disease or from carriers; and (2) those that enter the body through injury or decreased resistance. Microorganisms of the first class cause the communicable diseases such as measles and mumps; those of the second group cause infection of a wound and are the ones with which we are principally concerned in surgery. See paragraph 164 for further classification of microorganisms. Microorganisms capable of causing disease are described as "pathogenic." See paragraph 163 for classification of pathogens. Many microorganisms are nonpathogenic, that is *not* harmful to man.

b. Prevalence. Microorganisms are found almost everywhere: in the air, on uniforms, on the hands, on the furniture, on the feet, on flies and other insects, and on the floor. They are even taken into the body with every breath and with every mouthful of food. Fortunately, many of these are not harmful to you. Moreover your natural body defenses protect you to a certain extent against the harmful ones. As microorganisms are constantly present, even in the air itself, complete absence of microorganisms on items being used is impossible. The goal is to have as few microorganisms present as possible, by using all known preventive measures against infection and disease. Consequently, you must understand the principles of sterilization and disinfection and learn to use the best techniques possible. "Less than the best" should never be tolerated.

c. Destruction. There are many methods of destroying microorganisms, but some are more effective than others. Washing with soap and water, for example, eliminates many, but not all microorganisms by rinsing them from the skin. Sunlight and fresh air also kill many microorganisms by drying them out. Heat and chemicals kill most microorganisms by coagulation of the cells. Boiling kills most microorganisms, especially those producing communicable diseases, but some hardy types can withstand this procedure. Likewise, chemical solutions kill many microorganisms, but cannot be depended upon to kill all of them. Some microorganisms encase

themselves in a hard outer shell, forming what is known as spores. The only two known methods that assure complete destruction of microorganisms are steam under pressure (the autoclave) and burning (flaming or actual burning). These two methods destroy even resistant spores and leave an article sterile (absolutely free of all microorganisms). It is unfortunate that some articles are destroyed or injured by these two methods and therefore must be disinfected rather than sterilized. In the field or in the home a needle or a knife may be sterilized by holding it in a flame until the metal glows. If you use this method, do not wipe off the carbon deposit. This procedure would render an applicator or a bandage useless. Contaminated trash can be safely disposed of by burning it. In a hospital most sterile supplies are autoclaved. The method selected to destroy microorganisms is the one that will destroy the greatest number and yet leave the article in a usable condition.

424. Methods To Assure Absence of Microorganisms

a. Chemicals. Chemicals are frequently used to destroy bacteria on articles which cannot be subjected to heat. This method, however, is properly termed "disinfection." The efficiency of this method depends upon three factors: the concentration of the chemical, the type of material being disinfected, and the length of time the article remains in contact with the chemical solution. In general the following principles apply: (1) use a sterile, covered container; (2) have the article to be sterilized clean and dry; (3) completely submerge the article in the solution; and (4) soak the article for at least 30 minutes. Follow hospital procedure in the use of chemicals.

b. Heat. Sterilization by heat is the accepted method for all materials except those damaged by this process.

(1) *Dry heat.* Some surgical supplies, such as petrolatum, gauze strips covered with petrolatum, oil of various kinds, bone wax, and talcum powder may be disinfected by dry heat. These substances are exposed to circulating hot air for prolonged periods in ovens which read 350° F. Hot air disinfection is often used also for syringes, needles, and laboratory glassware.

(2) *Moist heat.* Moist heat is used to sterilize most articles.

(*a*) *Boiling.* Boiling is actually classified as disinfection, rather than sterilization. It should be used only when no autoclave is available. Boiling destroys most living microorganisms in a few minutes but does not guarantee the destruction of all spores, some of which (like those of tetanus or gas gangrene) resist many hours of boiling. The addition of sodium carbonate (3 to 4 teaspoons to a quart of water) adds to the effectiveness of boiling

water against spores. If the article is clean, boiling it in this solution for 30 minutes will kill living microorganisms and most spores. Be sure that the article is completely immersed.

(*b*) *Steam under pressure.* The autoclave, which provides steam under pressure, is the safest and most frequently used method of sterilizing hospital supplies. There are many types of autoclaves and improvements are constantly being made upon them. Learn the principles of operating an autoclave and adapt your knowledge to the type of equipment you find where you work. Read the directions carefully and follow hospital procedures regarding length of sterilization of various types of material.

425. Preparation of Supplies for Sterilization

a. General Rules. All articles to be sterilized must be clean and in good condition. Special methods are used in the cleaning and preparation of materials for sterilization, and frequently supplies and instruments are sterilized in packs. Different types of supplies require different types of sterilization and different handling. The specialist should learn the basic principles and then adapt his knowledge to the standing operating procedure of the hospital.

b. Wrapping Procedure. Articles to be sterilized are usually wrapped with muslin wrappers. Always use a double thickness of material, large enough to cover the contents completely. Place the wrapper on the table in a diamond shape with one point toward you. Center the item on the wrapper. Fold over the corner nearest you, then the right and left corners, and finally the corner opposite you. Always turn the tips of the corners back so that the pack, after sterilization, may be unwrapped without touching the inside of the contents of the pack. Strive for a firm, compactly-wrapped package. Place a Diack control (*c* below) in the package, label the package and secure it with a string or pressure sensitive tape. Pressure sensitive tape has light marks on it which turn dark when the tape is subjected to heat under pressure. It furnishes another way to confirm the fact that the item has been sterilized. Largest pack for the autoclave should not be more than 12 inches by 12 inches by 20 inches.

c. The Diack Control. Every load that goes through the autoclave is provided with a Diack control. This is a tablet of chemical substance, sealed in a small glass tube. The tablet fuses or melts if exposed to a temperature of 250° F. for 2.8 to 3.2 minutes or 246° F. for 27 to 35 minutes. At 242° F. it will not melt. Nothing but heat can cause fusion of the control. These characteristics indicate that the above temperature has been reached in the area of the Diack control. The coolest section of any sterilizer is always at the bottom,

near the door. The part of the load hardest for steam to penetrate is the center of the largest, most tightly-wrapped package at the bottom of the sterilizer. Diack controls may be placed in various locations in the autoclave and inspected immediately after the load is removed from the autoclave and before any of the load is taken away.

426. Using the Autoclave

a. General Principles.

(1) The pressure steam sterilizer or autoclave (fig. 120) consists essentially of a metal outer cylinder and a metal inner cylinder forming a steam jacket, both closed with one tight-fitting door. It is provided with pressure gauges, an operating valve, a safety or "pop off" valve, a thermometer, a thermostatic valve, an exhaust line with a waste trap, and a steam supply system with a pressure regulator, and a removable tray for loading (fig. 121). In the modern temperature-controlled, pressure steam sterilizer, the air is evacuated by the gravity method. Steam comes in at the back and through the exhaust line in the front. The steam may be supplied from a central point, or by water heated to boiling by a flame or electric coils beneath the sterilizer.

(2) When the cylinder of an autoclave is filled with steam under pressure, the steam gets hotter as the pressure increases. For every pound of increased pressure the temperature rises approximately two degrees.

(3) Steam serves as a medium for the transmission of moist heat from a source of energy (a fire or electric coils) to the objects to be sterilized. When it touches these cooler objects, the steam condenses to moisture on them as its heat energy is absorbed. More and more steam comes up and the temperature of the objects rises until they are as hot as the steam. Microorganisms are killed by this heat.

(4) The presence of air in the autoclave interferes with the amount of steam that can come into the system. As steam condenses, more steam enters; but air in the cylinder exerts resistance against steam coming in. It never condenses to moisture, allowing its place to be taken by hotter steam. Air acts as padding in the system; it reduces efficiency (table XI).

In operating an autoclave, it is important to exhaust all the air. Steam is lighter than air. When steam enters an autoclave, it remains at the top of the cylinder blanketing the heavier air and compressing it downward. As steam pours in, the air escapes through a valve at the bottom (*f* below). When all of the air is gone, the hot steam itself goes through the valve and heats the thermostatic control which closes the valve.

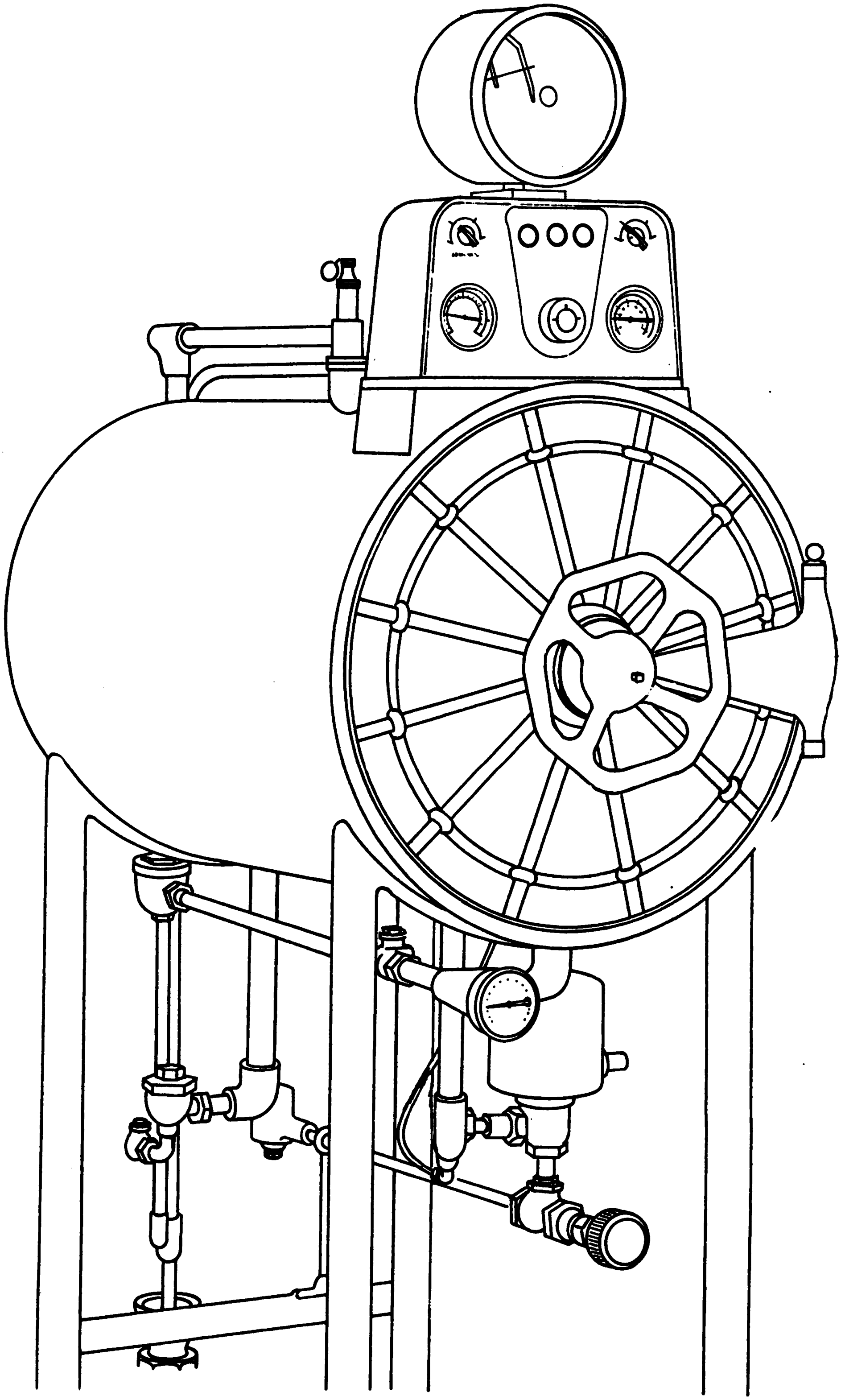


Figure 120. Steam pressure sterilizer (the autoclave).

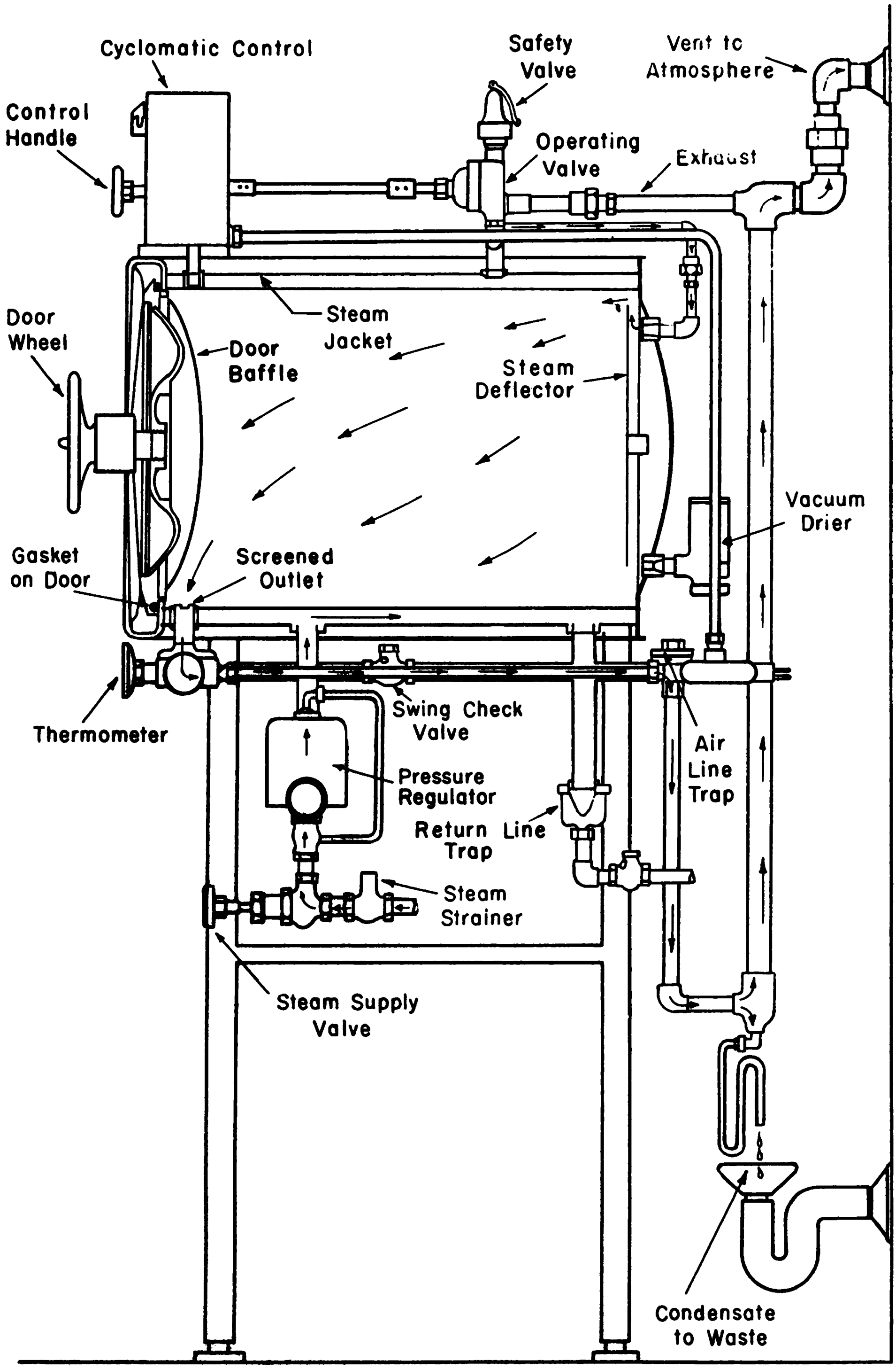


Figure 121. Cross section of an autoclave.

Table XI. Temperature of an Autoclave With Various Amounts of Air Discharged

Gauge pressure	Pure steam complete air discharge (° F.)	⅔ air discharged (° F.)	½ air discharged (° F.)	No air discharged (° F.)
5	228	212	202	162
10	240	228	220	193
15	250	240	234	212
20	259	250	245	228
25	267	259	254	240
30	275	267	263	250

b. Loading an Autoclave.

(1) Do not crowd the sterilizer. Leave space between packs for circulation of steam. Figure 122 illustrates incorrect and correct methods of loading an autoclave: in "A" the pack is too large, the steam cannot penetrate it; in "B" the packs are placed too closely together; they form, in effect, a large pack that the steam cannot penetrate; "C" illustrates how packs should be placed on end and separated so that the steam can easily flow down between them.

(2) The longer packs should be placed at the bottom.

(3) Enamelware or steel vessels and other equipment that might retain condensed water should be placed on their sides with lids laid alongside the containers so that they can be picked up without contamination and replaced after sterilization is completed.

(4) No large surface of any pack should lie against the wall of the sterilizer and so obstruct the circulation of steam about the pack.

(5) No pack, not even a small one, should be in contact with the top of the sterilizer.

c. Operating the Autoclave. As there are many kinds of autoclaves, you must carefully check the specific instructions which come with the one you are going to use. There are a few general steps, however, which are described below (fig. 123 illustrates the controls of an autoclave):

(1) Daily, before using the sterilizer, clean the strainer at the entrance to the discharge outlet. Free the screen of all lint, shreds of cotton, and sediment (*h* below).

(2) Turn on the steam and obtain a jacket pressure of 15 to 17 pounds. Place the load in the sterilizer. Close and lock the door.

(3) Turn the operating valve to "sterilize." This admits steam to the sterilizing chamber.

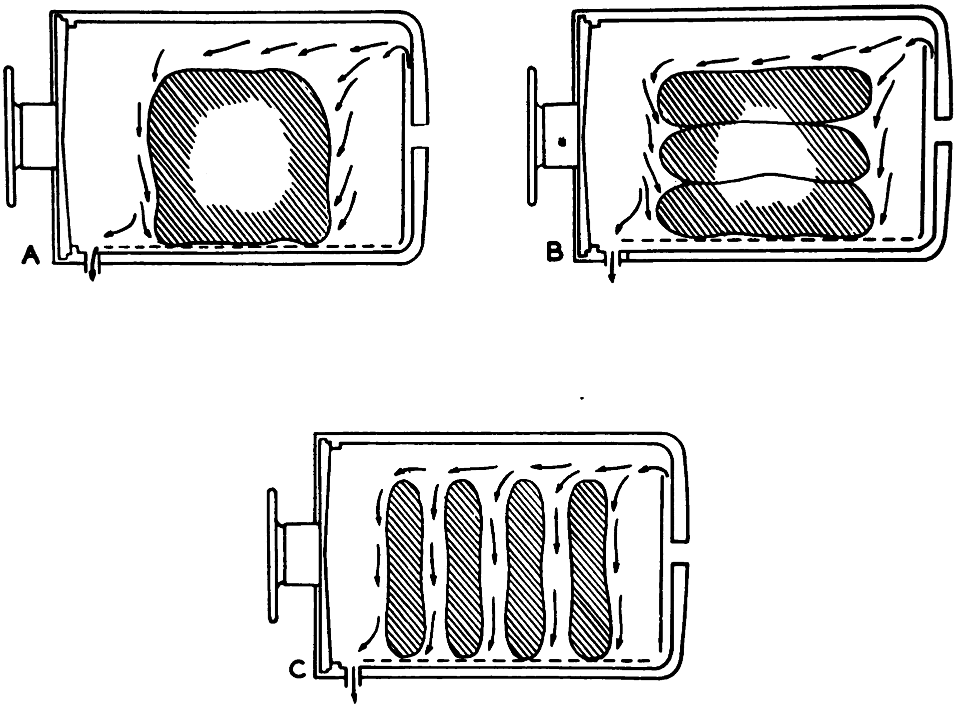


Figure 122. Placement of packs in an autoclave.

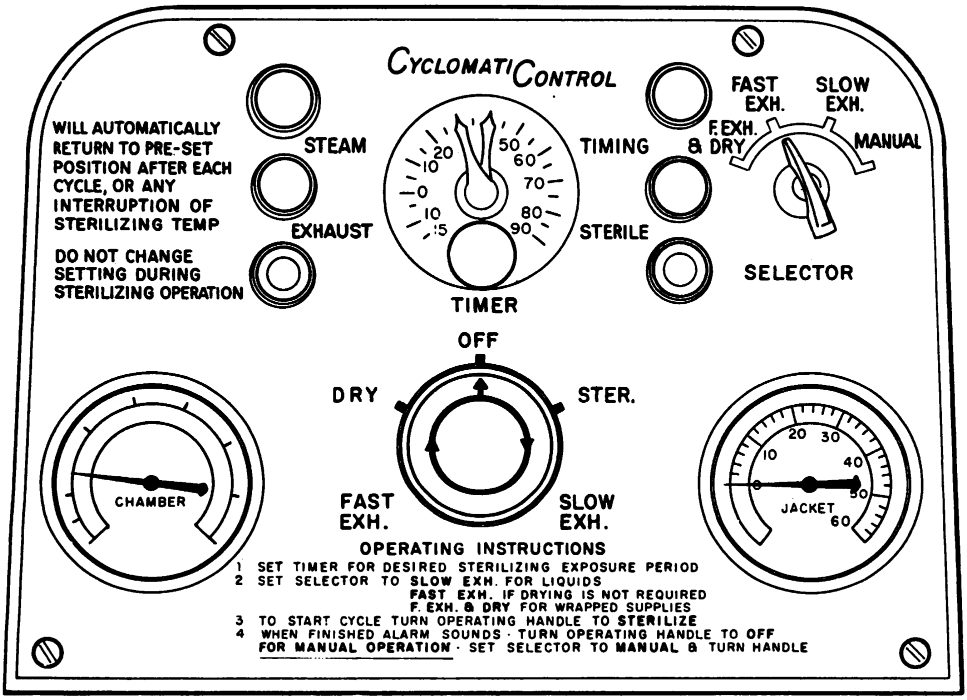


Figure 123. Dials and controls of an autoclave.

(4) Watch the discharge-line thermometer. The temperature shown by the thermometer will advance gradually to from 250° to 254° F. Timing of the period of exposure can safely begin when this temperature passes 250° F. The time needed to build up to 250° F. will be about 2 to 4 minutes.

(5) Begin to time the period of exposure when the discharge-line thermometer indicates 250° F. Check this point with the mercury thermometer, then the recording thermometer, if one is present. Regulate the heat control carefully so that the jacket pressure is maintained at 15 to 20 pounds throughout the sterilizing period.

(6) Throughout the period of sterilization, maintain a constant watch on the discharge-line thermometer. A temperature of 250° F., must be maintained for proper sterilization. If the temperature drops below 250° F., the entire cycle must be restarted.

d. Unloading. To remove materials (except solutions) from the autoclave, turn the operating valve to "exhaust" at the end of the period of exposure. When the chamber gauge shows zero pressure, turn the operating valve to "vacuum" position for 3 minutes. The vacuum removes excess moisture and helps dry the packages. Then turn the operating valve to "off" and open the vacuum breaker valve. (Some sterilizers automatically control breaking of vacuum when the operating valve is turned to "off.") Wear asbestos gloves to prevent burning yourself. When the chamber gauge shows zero pressure, unlock the door but do not open it. Loosen it just enough to permit vapor to escape. Leave the door "cracked" in this manner 5 minutes for light loads, or 10 minutes for heavy loads to allow them to dry. Once the door is cracked, a sign reading "sterile" should be hung on the door while the materials finish drying. Then open the door and remove the load. Warm packs cannot be set on a flat solid surface or on a metal surface as the condensation wets the pack, causing contamination. Set the packs on a rack to dry. Turn off the steam unless another load is to be sterilized at once.

e. Removing Solutions from the Autoclave. Leave the operating valve at "sterilize" and turn off the steam supply valve at the end of the period of exposure. Wait until the chamber gauge shows zero pressure before you open the door and remove the flasks. If an autoclave containing solutions is set on "vacuum," the solutions boil out of their containers.

427. Dating and Storing Sterile Supplies

When sterile supplies are removed from the autoclave, they are dated by marking the outside wrapper with a washable type marker. Never date a package before it is autoclaved. Place all sterilized supplies in specially designated storage cupboards. These cupboards

should be clean, dry, and free from dust. Place like items together and arrange them according to expiration date, placing items with later dates toward the back. Check supplies periodically to determine necessity for reautoclaving. Items must be resterilized if the wrapper becomes wet, if the package is dropped on the floor, if there is an question of possible contamination, or if the safe storage period has expired. All sterile supplies must be resterilized after the period prescribed by hospital regulations.

428. Cleaning the Autoclave

Once a week wipe out the entire autoclave with a damp cloth and polish the outside. Clean the plug screen outlet or strainer (fig. 121) daily. This plug is the key to efficient operation of every sterilizer. It must be kept free from all sediment and lint. If it becomes clogged, air is trapped in the chamber of the autoclave. The effect of trapped air upon lowering the temperature has been shown in paragraph 426*a*(4). Once a week make a hot solution of trisodium phosphate (a tablespoon to a quart of water) and pour it through a funnel into the chamber discharge line. This will help to keep the discharge system in good condition by removing greasy substances.

Section XIII. STERILE TECHNIQUE IN THE USE OF THE DRESSING CHART

429. The Chain of Asepsis

Sterile, or aseptic, technique is a term used to describe a procedure which seeks to prevent infection or the spread of infection by insuring that everything coming into contact with a break in the skin or a body cavity is sterile. The term "sterile" means the complete absence of all living microorganisms. Numerous procedures are performed on the ward which necessitate the use of sterile technique. To set up equipment properly for these sterile ward procedures and to assist with them or to perform them, you must know and must practice the principles of sterile technique. The steps carried out to insure sterility are described as the "chain of asepsis." Each step is considered a link in the chain; if one step is violated, sterile technique collapses.

430. The Principal Steps in Sterile Technique

a. Wash your hands thoroughly before beginning any sterile procedure, to rinse off surface bacteria and make hands as clean as possible. Follow the hand washing procedure recommended by the hospital. For some sterile procedures, gloves are used.

b. Use only sterile supplies. Supplies must have been sterilized by the best available method, stored, and handled properly to avoid contamination.

c. Keep equipment sterile during preparation for the procedure and while it is being performed. Maintain sterility of articles in use by handling them with sterile gloves or instruments.

d. Discard any object which becomes contaminated. A sterile object that touches anything not sterile is considered contaminated.

431. Use of the Dressing Cart

One of the most frequent practices of aseptic technique on the ward is in the use of the dressing cart. This cart (fig. 124) is rolled to the patient's bed when a sterile procedure is to be performed or when a dressing is to be changed. It is a portable treatment room, stocked according to the needs of the ward. The cart must be prepared properly; it must be checked frequently for adequacy of supplies and for their sterility; and it must be cleaned routinely and kept ready and available at all times. Principles of aseptic technique must be followed when using the cart. Properly used, the dressing cart saves time and energy of personnel; improperly used, it can spread infection from one patient to another.

432. Contents of the Dressing Cart

Certain areas of the dressing cart are specifically designated for sterile, clean, or soiled supplies. Sterile supplies properly packaged

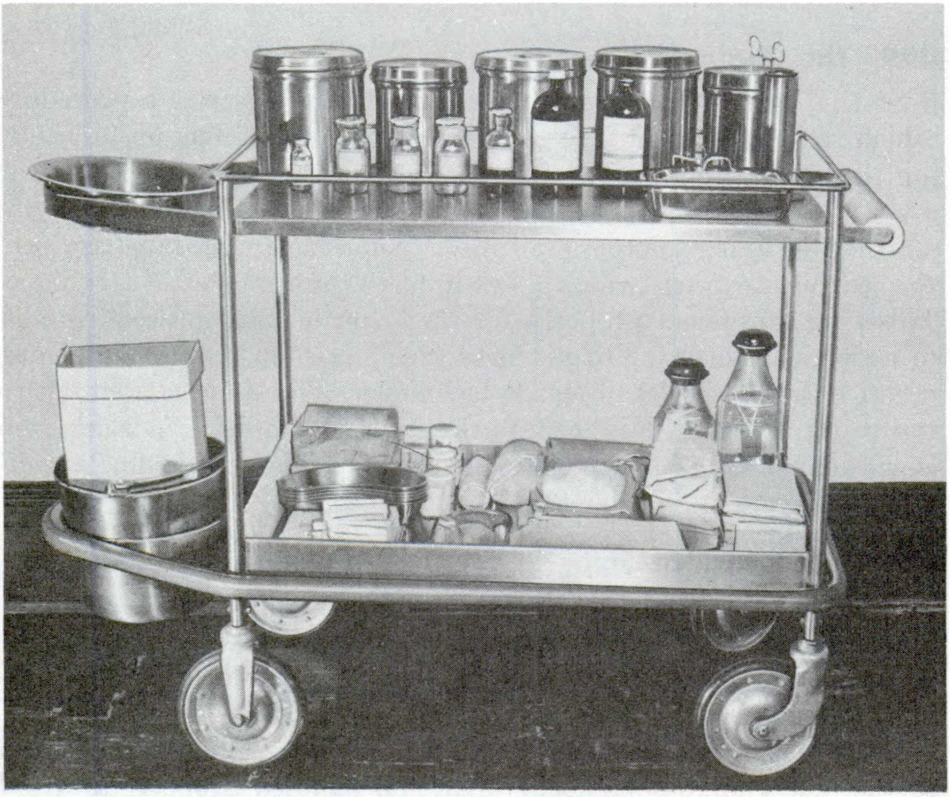


Figure 124. The dressing cart.

are kept on the top shelf and one section of the lower shelf. Clean supplies are kept on one section of the lower shelf. Soiled dressings are wrapped in newspaper or placed in a paperbag and discarded into the bucket. Used instruments, emesis basins, and the like, are placed in the basin at the end of the cart. Clean, unused dressings, towels, and other material which must be returned to the Centralized Materiel Section for resterilization are placed in the bag at the end of the cart under the adhesive rack. Soiled linen to be laundered is placed in the bag on the back of the cart. The cart usually contains sterile equipment such as individually wrapped pads of various sizes, hand towels, packages of petrolatum gauze, tongue depressors, applicators, rubber drainage tubing and connectors, syringes, basins, covered jars containing pads, sponges, safety pins, dressing sets, a transfer forceps in a container, antiseptics, ointments, and solutions. Unsterile equipment found on the cart usually includes such items as adhesive, bandage scissors, folded newspapers, assorted bandages, jars of pins, bandage fasteners, and rubber bands.

433. Handling the Transfer Forceps

(fig. 125)

Transfer forceps are used to transfer sterile materials to the sterile field which has been set up for the patient. They are received sterile

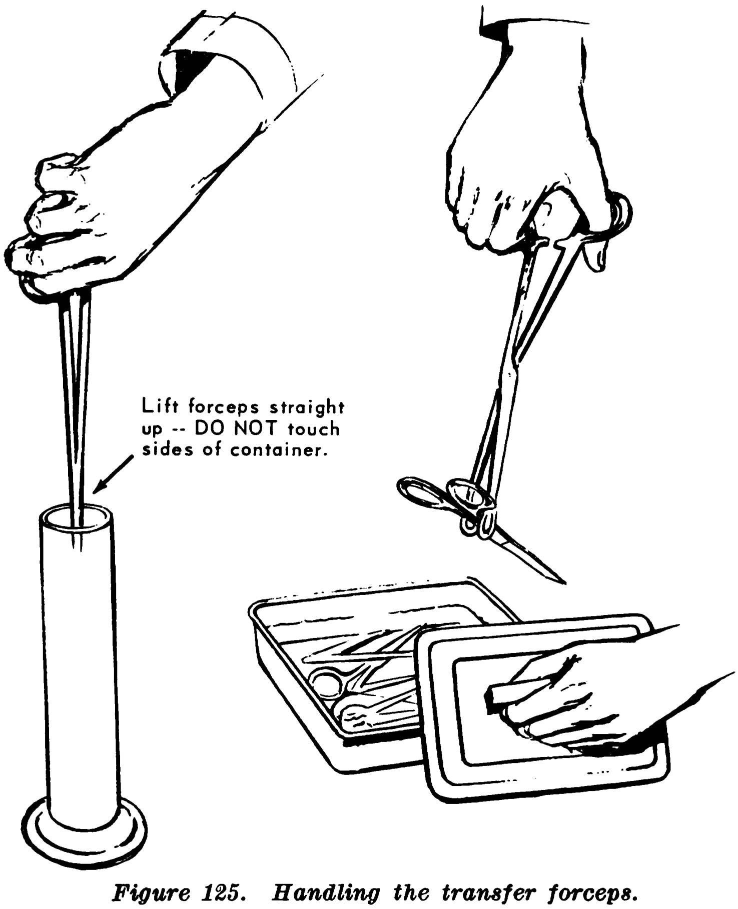


Figure 125. Handling the transfer forceps.

from the Centralized Materiel Section and are placed on the cart in their sterile container. The disinfectant solution in the container must always cover the clamp of the forceps, and the clamp must always be kept open while the forceps are in the solution. The transfer forceps have both a sterile and an unsterile section: the handle grasped by the user is unsterile; the end submerged in the solution is sterile. To carry out aseptic technique in using the dressing cart, you must know how to handle the transfer forceps correctly. Remember to keep them pointing downward at all times. If you do not do this, the solution will run over the unsterile part and then back over the sterile part, contaminating the forceps.

434. Dressing a Clean Wound

a. *Preparation of the Patient.* Changing a dressing is an aseptic procedure. Be sure to wash your hands thoroughly before doing any dressing and between each dressing. Take the dressing cart to the bedside. Always prepare the patient by explaining to him what is going to be done. Screen him if he is in a ward, make him as comfortable as possible, and then expose the area to be dressed.

b. *Setting up a Sterile Field.* Place the dressing pack, the emesis basin, and some newspaper or paper bags at the foot of the bed. Place near the back of the bedside stand a bottle of skin-cleaning solution. Next, set up a sterile field as follows:

(1) Open the dressing pack, being careful not to touch the inside of the wrapper. (The wrapper is used as a sterile field. It is considered sterile within 1½ inches of its border.)

(2) With transfer forceps move the towel to one side. (The towel may be used to cover the sterile field if there is some delay in beginning the procedure; or it may be placed under the wound to provide a clean field.)

(3) Pick up the dressing forceps with the transfer forceps and place so that the handle is just off the edge of the wrapper. This is done so that when the dressing forceps are picked up, the field will not be contaminated.

(4) With the transfer forceps, remove from the jars on the cart any additional gauze squares that will be needed for the procedure. Place these on the sterile field.

c. *Changing the Dressing.*

(1) Remove the outer dressing with your fingers: hold the skin taut and pull off the adhesive toward the wound.

(2) Using dressing forceps, pick up the towel. Grasp the corner of the towel with the other hand; return the forceps to the dressing pack. Grasp the second corner of the towel and place the towel under the wound or next to it. The towel provides a sterile field.

(3) Remove the inner dressing with the forceps. Examine the dressing and the wound. Discard the forceps into the basin.

(4) Using another forceps, pick up a 2 by 2 gauze sponge, hold it over the emesis basin and pour over it a skin cleansing solution, such as hydrogen peroxide.

(5) Cleanse around the wound edges. Work outward from the wound edges and do not retrace. Use additional sponges, if necessary. Discard all sponges on the newspaper (fig. 126).

(6) Dry the area with additional 2 by 2 gauze sponges held in the same forceps.

(7) Place gauze sponges on the wound. Number and size of sponges will be determined by the size of the wound and the amount of drainage. The dressings should extend at least two inches beyond the wound edges on all sides.

(8) Secure the dressing with adhesive strips.

(9) Make the patient comfortable.

(10) Place all used instruments in the soiled instrument basin. Place the towel and the wrapper in the bag for laundry. If unused, place the towel and wrapper in the bag for return to CMS.

(11) Wrap the soiled dressing securely in a newspaper and place in the bucket on the cart.

(12) Remove the cart from patient's unit.

(13) Wash your hands before going to the next patient.

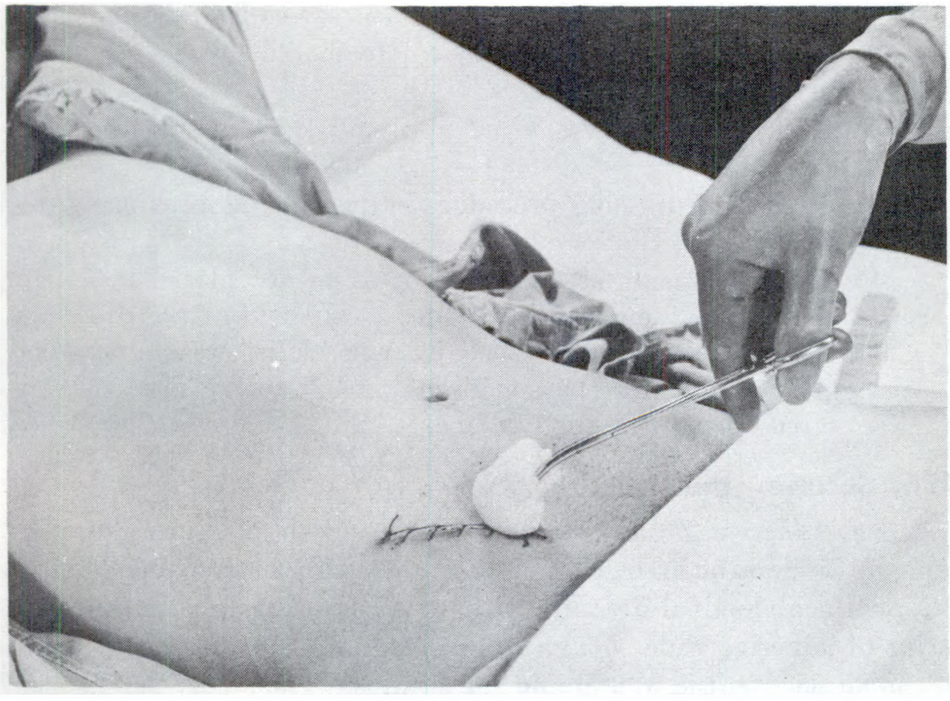


Figure 126. Cleansing the wound.

435. Dressing Draining Wounds

a. A draining wound (dirty, septic, or infected wound) is dressed in the same manner as the sterile wound, previously described. Every precaution must be taken to prevent the spread of the infection to other sites on the patient, to the specialist, and to other personnel.

b. If the dressing is stuck to the edges of the wound, loosen it by moistening with a solution ordered by the ward surgeon. Use a sterile Asepto syringe set containing a small sterile basin for the solution. Hold a sterile emesis or kidney basin beneath the dressing to prevent the solution from soiling the bed. As the crust becomes softened by the solution, gently lift off the dressing with forceps and discard it on waste paper. Discard the forceps into the emesis basin.

c. Draining wounds are often irrigated with peroxide or other antiseptic solutions, as ordered. Use sterile materials. Place the tip of the syringe into the wound to wash out the pus. The drainage is caught in a basin held below the wound.

d. The drainage from infected wounds is often irritating to the surrounding skin. Petrolatum gauze or other ointments may be ordered to protect the skin.

e. Wounds infected with virulent pathogenic bacteria (such as the gas bacillus in gas gangrene cases) call for absolute isolation technique. If you permit a break in your dressing technique, you endanger yourself and others with a most deadly germ.

(1) Isolate such patients (par. 496). Use a separate dressing tray or cart and dress these cases *after* the "clean" ones. The best technique is to have one specialist care only for these seriously infected cases. He should not be permitted to care for the clean cases.

(2) Wear rubber gloves when applying the dressings in such cases.

(3) Change of dressing procedure is the same as previously described.

(4) All instruments used for the dressing are placed in a pan or basin as they are discarded. At the end of the dressing, all instruments are washed by a specialist wearing rubber gloves, and must be sterilized immediately. The basin is cared for in the same manner.

436. Securing the Dressing

a. By Adhesive Tape. Dressings are held in place by adhesive tape, by binders, or by bandages. For a dressing on the abdomen reinforce the abdominal dressing with an ABD pad (fig. 127) and use strips of adhesive wide enough to give support and prevent the pull of the muscles on the wound and the sutures. The strips should also be long enough to extend well around to either side. Adhesive tape

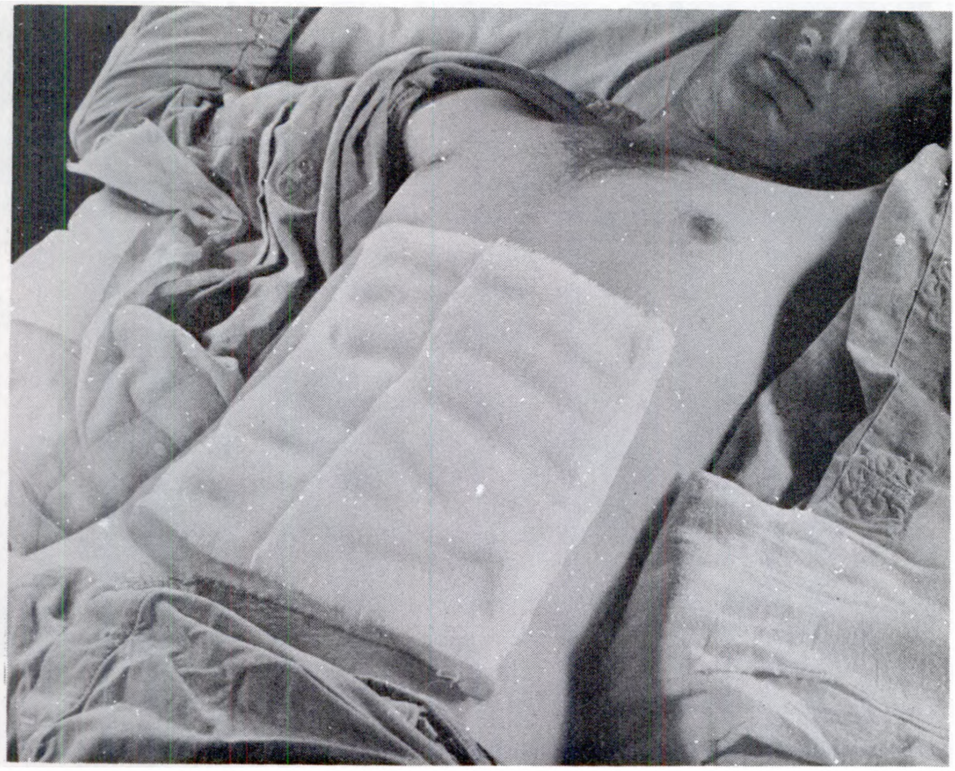


Figure 127. Abdominal dressing reinforced with ABD pad.

must not be applied over an abraded skin. If it is necessary to do a daily dressing, use measures to prevent skin irritation and discomfort to the patient caused by the daily removal of adhesive.

b. With a Montgomery Strap. One of the most frequently used devices is the Montgomery strap (fig. 128). Cut two 9-inch long strips of 2-inch wide adhesive tape and a 24-inch strip of roller bandage. Cut a small hole one inch from the folded edge. Using tincture of benzoin to protect the skin and hold the tape, place the strips opposite each other and far enough from the wound to allow space for the dressing. Lace the bandage through the holes, draw the strips together and tie over the dressing. Montgomery straps are always made in pairs. The number and size of the pairs vary with the size of the dressing used. These straps eliminate the need of pulling off the adhesive tape each time the dressing is changed.

c. With the Scultetus Binder. The scultetus, or many-tailed binder (fig. 129), is often applied over a dressing when abdominal support is desired. It may be used also on other parts of the body, such as the chest, legs, or arms, if it is necessary to inspect or to change dressings without moving the part. The ends of the binder are dovetailed together and the last one fastened with a safety pin.

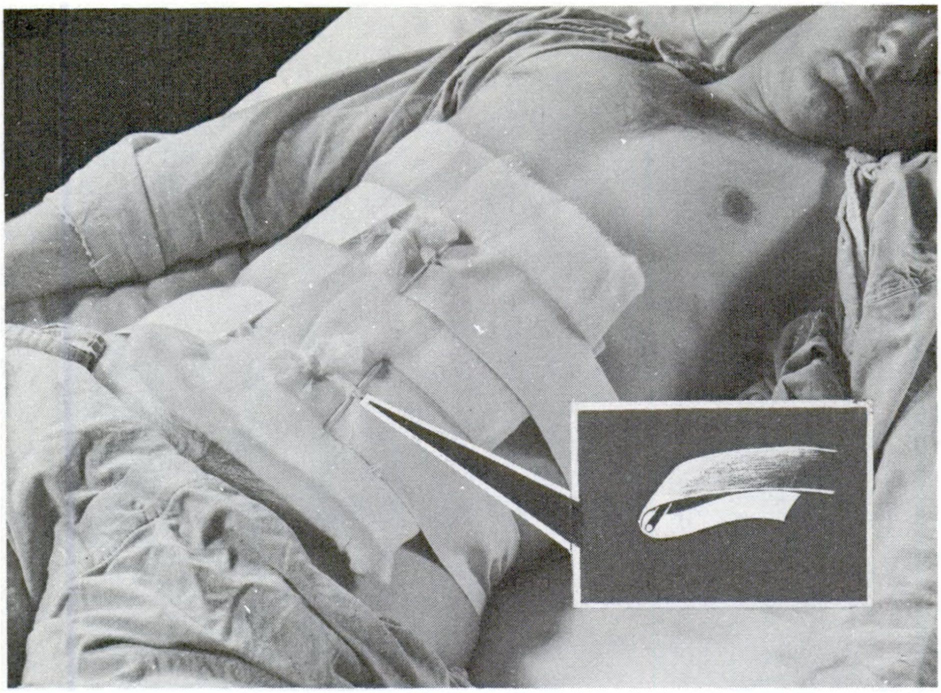


Figure 128. Montgomery strap.

d. With Tailed Binders. The T-binder and the double T-binder are often used to secure dressings over the rectum and external genitals. The four-tailed bandage is used to hold dressings on the jaw, nose, forehead, and back of the head. All these bandages and their uses are described and illustrated in FM 8–50.

e. Butterfly Suture. Some minor lacerations or incisions can be closed readily with specially prepared strips of adhesive tape called "butterfly sutures" (fig. 130). This technique may be used when a wound is superficial, with no muscle damage, and is located on a flat surface where there is no unusual stress or pulling.

(1) To make a butterfly suture, use a strip of adhesive tape suitable in length and width for the wound. In each side, cut two diagonal slashes toward the center of the strip. Then fold under the cut edges (or flaps). Before applying the suture, sterilize the folded edges by painting them with merthiolate. Another way to make a butterfly suture is to fold a strip of tape back on itself, then cut the corners from the folded end to form wide nicks when the strip is unfolded.

(2) Clean the wound area. Apply the suture with pressure (fig. 130). Cover it with a sterile dressing. When the wound has healed, remove the tape gently to avoid pulling apart the edges of the wound.

f. Other Bandages and Dressings. See paragraphs 171–176.

Figure 129. Abdominal binder.

Applying abdominal binder

Figure 129—Continued.

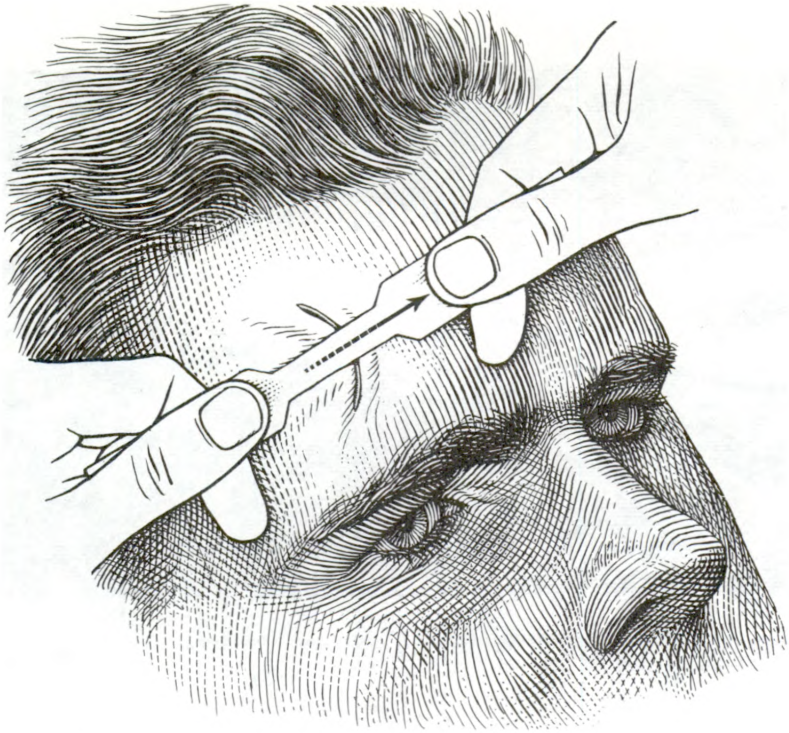


Figure 130. Closing a wound with a butterfly suture.

437. Cleaning and Restocking the Dressing Cart

a. General. In some installations the dressing cart is set up and then replenished at the end of each day in the Centralized Materiel Section. In most hospitals, however, it is cleaned on the ward at the end of each day and is replenished as needed by supplies ordered from CMS.

b. Care of the Cart After Each Use. Clean the soiled areas on the cart, put all supplies in their proper places, and restock items as needed.

c. Cleaning and Restocking the Cart Daily. Each day remove everything from the cart and wash the cart thoroughly. Empty the bag containing wrappers, towels and clean dressings and dispose of them according to hospital procedure. Empty the bag of soiled dressings and replace it with a clean bag. Empty, wash, dry, and replace the bucket. Rinse instruments and emesis basins in cold water, wash with soap and water, rinse, dry, and put in designated place to send back to CMS. Replace the transfer forceps, check dates on sterile supplies, and send back any items whose sterile period has expired to CMS for resterilizing. Replace all supplies according to the ward standing operating procedure. Use the check card tied to the cart to make sure all needed supplies are present.

CHAPTER 10

SPECIAL PROCEDURES IN NURSING CARE OF THE PATIENT IN THE HOSPITAL

Section I. GASTRIC AND INTESTINAL INTUBATION AND RELATED PROCEDURES

438. General

a. Explanation and Purpose. Gastric and intestinal intubation is the process of passing a tube through the nose or throat and esophagus into the stomach or intestine. A patient is intubated for one or more of the following purposes:

(1) To obtain specimens of gastric and intestinal juices or contents for laboratory analysis.

(2) To relieve distention of the stomach or intestine, or to keep an obstructed bowel empty prior to surgery.

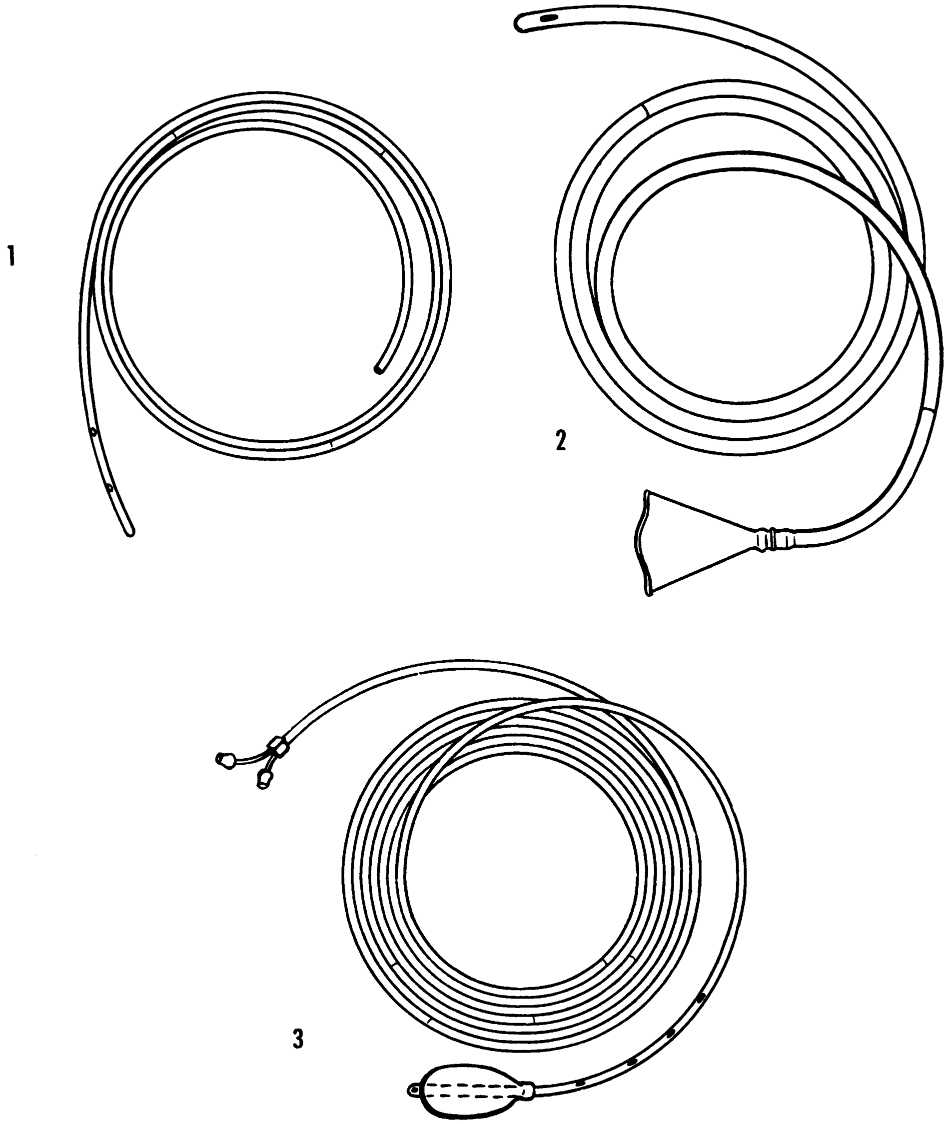
(3) To wash out the stomach (*gastric lavage*) prior to surgery or in case of poisoning and some types of stomach disorder.

(4) To feed or to administer drugs to unconscious, uncooperative, or extremely weak patients. (Tube feeding is called *gavage.*)

b. Types of Tubes.

(1) *Levin tube* (1, fig. 131). This tube is flexible with soft walls, and is about four feet long. It has a rounded tip with multiple holes and is marked by single circular rings at 10 cm. intervals, the first being 50 cm. from the tip. The Levin tube is used primarily for long-continued gastric and intestinal drainage, for gavage (tube feedings), and gastric lavage (stomach washing). It may be used also for diagnostic purposes. Its chief advantage is that it can be inserted either nasally or orally and that it is firm enough to be passed in an unconscious patient but flexible enough so there is little danger of producing injury. The chief danger in passing this tube is in entering the trachea, rather than the esophagus.

(2) *Stomach tube.* This is a large-caliber, heavy-walled, and fairly stiff tube with a rounded tip and with a funnel at the other end (2, fig. 131). It is used primarily for lavage. It is stiff enough to be readily inserted through the mouth



1 Levin
2 Stomach
3 Miller-Abbott

Figure 131. Gastric and intestinal tubes.

into an unconscious or poorly cooperative patient or one with a hypersensitive gag reflex. The chief danger lies in its stiffness, which makes it capable of doing severe damage in the larynx or perforating the stomach or esophagus if it is not carefully used.

(3) *Miller-Abbott tube* (3, fig. 131). This is a 10-foot intestinal tube with a double lumen and a small balloon near its tip. The tube has markings that indicate the distance it has been passed. One lumen of the tube is used for aspiration, the other for inflating the balloon. These two openings are in-

dependent of each other. This tube is inserted nasally and when the first mark is at the patient's nose, suction is started. Peristaltic action carries the balloon and the tube through the intestine.

439. Responsibilities of the Specialist

Although the doctor is usually the one who inserts the tube, the medical specialist must know enough about intubation to be able to prepare the equipment, to prepare the patient and care for him during the procedures, and to assist the doctor. If the doctor has not done so, the specialist should explain the procedure to the patient. He should also place the patient in the proper position (either the Fowler's position or sitting in a chair). The specialist selects and prepares the equipment needed and ordered by the doctor. He then assists the doctor, as needed, or performs the intubation, if the doctor orders it.

440. Intubation Technique (Nasal)

a. General Considerations. This procedure is done to allow for gastric or intestinal drainage, for gastric lavage or gavage, or to obtain a specimen of stomach or intestinal contents.

b. Special Precautions.

(1) When passing the tube, do not use force.

(2) Observe the patient for choking, coughing, or cyanosis, and remove the tube quickly if any of these occur.

(3) If the patient being intubated is unconscious, be especially observant for signs of cyanosis or respiratory distress. It is very easy to pass a tube into the trachea of an unconscious patient, especially if his swallowing reflex is gone. Test carefully and repeatedly for air after 12 to 15 inches of the tube have been passed.

(4) Never inject any substance into a gastric or an intestinal tube until you have first aspirated stomach contents, whether the patient is conscious or unconscious.

c. Equipment.

(1) Gastric or intestinal tube. (If the tube is rubber, place it in a basin of cracked ice to stiffen the tube and make it easier to pass; plastic tubes are not placed in ice.)

(2) Emesis basin.

(3) Lubricating jelly.

(4) Syringe (30 cc. with adaptor).

(5) Paper towels or mouth wipes.

(6) Glass of ice water and glass drinking tube, if allowed.

(7) Bath towel.

(8) Test tube (if a specimen is to be obtained).

(9) Rubber sheet with cover.

d. Preparation of the Patient.

(1) Explain the procedure to the patient, screen his bed, and then place him in Fowler's (sitting) position.

(2) Secure the bath towel around the patient's neck, and place the rubber sheet over his pillow and the upper part of his sheet.

e. Procedure and Care of Patient During Procedure.

(1) Remove the tube from the ice water. Lubricate the tip very lightly.

(2) Ask the patient to tilt his head slightly backward.

(3) Hold the tube about 6 inches from the tip. Rotate it until you find the position of greatest "droop."

(4) Holding the tube in this position, pass it through the patient's nostril into his pharynx. Ask the patient to swallow at regular intervals; if allowed, let him have a few sips of water to make sure that he will be able to swallow as often as desired. Each time he swallows, insert the tube a few inches. If the patient has a tendency to gag, tell him to breathe deeply through his mouth. Continue inserting the tube until the second marker on the tube is at the patient's nose. Do not force the tube at any time. (If the patient starts coughing, choking, or if he becomes cyanotic, remove the tube quickly. Let the patient rest a few minutes and re-insert the tube.)

(5) Make the following tests to be sure that the tube is not in the trachea (if the tube is in the trachea, withdraw it and start over):

(*a*) Listen for the movement of air at the end of the tube.

(*b*) Feel for air at the end of the tube or hold the tube under water to see if it bubbles.

(*c*) Attach the syringe to the tube and aspirate gastric contents. If no gastric contents return, it may be due to any one of the following reasons:

1. The tube is kinked in the patient's stomach.

2. The tube is obstructed by a mucus plug or other foreign material.

3. The tube is in the patient's trachea, despite the fact that tests (*a*) and (*b*) were negative.

(*d*) *Do not inject anything into the tube until you have aspirated gastric contents.*

(6) To remove the tube—

(*a*) Place the towel near the patient's chin.

(*b*) Pinch the tube at the patient's nostril so that no fluid from the tube will spill into the patient's trachea.

(*c*) Remove the tube smoothly and quickly and place it in the towel.

f. Care of Patient Following Procedure. Make the patient comfortable and his unit tidy before you take the soiled equipment to the utility room.

(1) Wash the patient's face, and let him rinse his mouth.

(2) Change any of his bed linen that was soiled during the procedure.

(3) Adjust his bed so that it is comfortable.

(4) Remove the screens.

g. Care of Equipment. Wash rubber tubing, syringe, and metalware and store them in their proper places. If a plastic tube was used, discard it. Wash and dry the rubber sheet and return it to its proper place.

441. Variation of Intubation Technique

The technique for intubation with a Miller-Abbott tube is the same as that described above, except for the following considerations: a Miller-Abbott tube is passed into the stomach with the patient sitting up. After the tube has been introduced into the stomach, the tube is advanced slowly (1 or 2 cm. at a time) usually at intervals of 1 hour. This procedure cannot be done rapidly as the tube will curl up in the stomach. When the third mark on the tube (26 inches from the tip) has been passed, aspirate the contents with a syringe. The fluid in the stomach is acid; in the duodenum it is alkaline and bile stained. If the aspirated fluid turns red litmus to blue it has come from the duodenum.

442. Suction Drainage of Stomach or Intestine

a. General. There are many types of suction equipment but they all operate on the same principle: the pressure in the drainage bottle is lower than that in the stomach. This causes the contents of the stomach to be siphoned into the drainage bottle. Suction drainage of the stomach or intestine is indicated when ordered by a doctor—

(1) To relieve or prevent abdominal distension.

(2) To remove gas or fluids from the gastrointestinal tract, to relieve intestinal obstruction.

(3) To relieve the patient's postoperative nausea and vomiting.

b. Special Precautions.

(1) When passing the Levin tube or the intestinal tube, observe the same precautions as those listed in paragraph 440*b*.

(2) Do not irrigate the tube unless the doctor orders it.

(3) Do not disturb any of the bottles in the Wangensteen apparatus except the bottle in which the gastrointestinal contents are collected. Follow the special instructions noted in paragraph 443 when you empty and clean this bottle.

443. The Three Bottle Method (Wangensteen)

This method employs the principle of using a vacuum. A partial vacuum is created in the drainage bottle by the flow of water from the bottle at the top of the apparatus to the bottom bottle (fig. 132).

a. Equipment. As listed in paragraph 440*c*, plus the following items:

(1) A 3-bottle siphonage unit.

(2) A glass connecting tip, with which the Levin tube is connected to the siphonage unit.

(3) Adhesive strips, ½ inch wide and 4 to 6 inches long. Two or three of these strips are generally needed to affix the Levin tube to the patient's face.

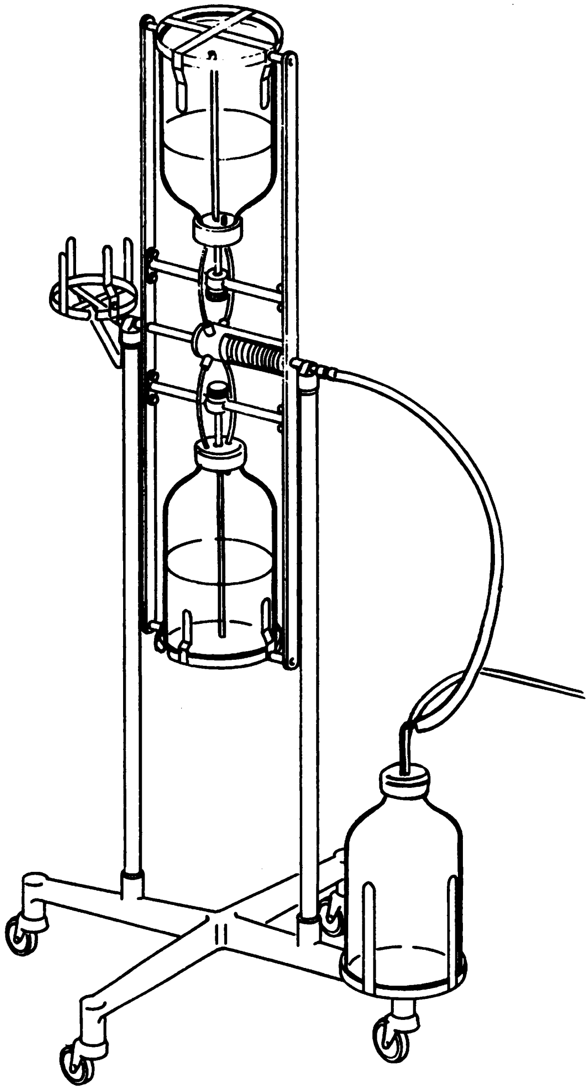


Figure 132. Wagensteen apparatus.

(4) A safety pin, used to fasten the tubing to the patient's sheet.

b. Preparation of the Equipment. Prepare the equipment in the utility room, proceeding as follows:

(1) Put the Levin tube in a basin of ice.

(2) Close the clamp on the tubing of the drainage bottle, but do not attach the glass connecting tip to the tubing at this time. The reason for this precaution is that the connecting tip is made of readily fragile glass, and might be broken in taking the equipment to the patient's bedside. For both safety and economy, wait until you are at the patient's bedside to place the connecting tip into the tubing.

(3) Invert the center bottles of the siphonage unit. The water will then start flowing from the top bottle into the bottom one.

(4) Open the clamp and test for suction by placing your finger over the opening; close the clamp.

(5) Take all the equipment to the patient's bedside.

c. Preparation of the Patient. Explain to the patient what is to be done.

d. Procedure.

(1) Introduce the Levin tube (par. 440).

(2) Place the glass connecting tip into the tubing of the drainage bottle; attach the Levin tube to the connecting tip and open the clamp.

(3) Tape the Levin tube to the patient's forehead or cheek.

(4) Pin the Levin tube to the patient's bottom sheet. Catch a portion of the sheet on either side of the tube, leaving the tube so that it can slide whenever the patient moves.

(5) During the treatment, invert the center bottles whenever the top bottle becomes empty, so that suction will be maintained continually.

(6) Empty the drainage bottle when it becomes two-thirds full, or every 24 hours. To empty the drainage bottle:

(*a*) Close the clamp on the tubing to the center bottles and on the Levin tube.

(*b*) Remove the cap, and take the drainage bottle to the utility room.

(*c*) Measure and note the contents.

(*d*) Rinse the bottle with cold water and wash it with soap and water.

(*e*) Replace the bottle, affix the top, and open the clamps.

(7) Observe the suction apparatus at frequent intervals. If there is any sign that the siphonage is not working, report it to the nurse. Any alteration in the rate of flow of the water from the top bottle to the bottom one is an indication

that the apparatus is not functioning properly. If the water is not going through, or if the solution is passing quite rapidly from the top to the bottom bottle, report it immediately.

e. Care of the Patient During the Treatment.

(1) Because the tube is irritating to the mucous membrane of the patient's nose and throat, it is important that special care be given to the patient's mouth and nostrils. Give the patient mouth care at least every 4 hours, or as often as he requests it. Allow him to rinse his mouth with mouthwash; if he is able to do so, let him brush his teeth. If he has dentures, clean them for him. If the patient is unconscious, cleanse his mouth, as described in paragraph 380.

(2) Apply oil or ointment to the patient's lips and nostrils; this should be done at least every 4 hours.

(3) Use special care when you move or turn the patient, so that the tube will not be pulled too tightly.

(4) Observe the patient closely; report to the nurse any complaint of nose or throat irritation. Immediately report any sign of blood in the drainage, and whether the blood is bright red or dark brown, and partially digested. (Partially digested blood has an appearance similar to that of coffee grounds, and for that reason is described as "coffee grounds" drainage.)

(5) Most patients are not allowed to have anything by mouth while tube drainage is functioning. Follow the patient's diet orders exactly. Clear fluids only may be given, and even these may be restricted. Do not give milk, unstrained fruit juice, nor cream soups. The milk curd or the fruit pulp will obstruct the tubing. Sometimes the patient is not allowed to have even water by mouth; if he may have water, however, be careful not to give him excessive amounts. The water will be withdrawn from the stomach through the tube, but some of the stomach's hydrochloric acid will be withdrawn, too. This process would soon cause the patient to contract a condition known as alkalosis.

(6) Keep an accurate record of the patient's intake and output. The doctor needs this information as a vital part in planning the patient's treatment (pars. 404–408).

(7) Do not advance nor withdraw the tube unless the doctor orders it.

(8) The tubing may become clogged with mucus. Inject a warm, normal saline solution down the tube with an Asepto syringe or a regular 30 cc. syringe. Inject about 30 cc.; wait 5 or 10 minutes and then connect the suction drainage again.

It is not advisable to use the syringe for suction, as it develops too much pressure.

(9) Chart on the nursing notes, or report to the nurse—

(*a*) The time of starting the treatment,

(*b*) The patient's reaction to the treatment, and

(*c*) Describe the drainage as to amount, color, and odor each time you empty the bottle.

(10) Prior to removal of the tube the doctor may order it clamped off for an hour or two to test the patient's tolerance. If no vomiting or other untoward effects occur, he may then order the tube removed.

f. Care of the Patient Following the Treatment. When the doctor orders the Wangensteen discontinued and the tube removed, remove the tube as described in paragraph 440*c*(6). Make the patient comfortable and his unit tidy as noted in paragraph 440*f*.

g. Care of the Equipment.

(1) Clean the tubing, the drainage bottle and cap according to the standing operating procedure of the hospital.

(2) Wash the Levin tube before returning it to the Centralized Materiel Section to be sterilized. If a plastic tube was used, discard it.

(3) Wash all metalware used.

(4) Return all equipment to its proper place, and return borrowed equipment to the Centralized Materiel Section.

(5) When cleaning the Wangensteen apparatus, do not disturb the center bottles.

444. Improvised Suction Drainage Apparatus (1, fig. 133)

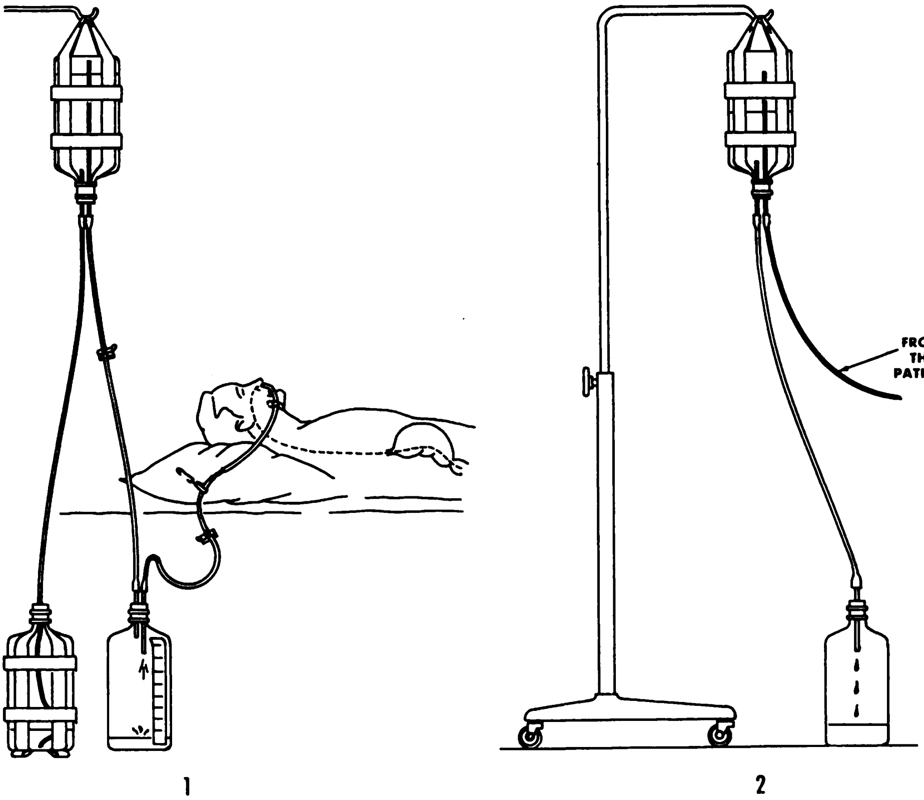
If you do not have a Wangensteen apparatus available, you can easily improvise one. Three bottles are used in the method described below, but a two bottle apparatus (2, fig. 133) can be used also.

a. Equipment. (Assemble in the utility room.)

(1) Bottle No. 1 with a 2-hole rubber stopper with one long and one short glass tube. (The rubber tubing from Bottle No. 3 is connected to the long glass tube and the rubber tubing from the short glass tube is connected to Bottle No. 2.) Improvise a hanger for the bottle. Fill the bottle almost full of water. (The tip of the glass tube must extend above the water level when the bottle is inverted.)

(2) Bottle No. 2, with the rubber tubing from Bottle No. 1 in the bottle.

(3) Bottle No. 3, with a two-hole rubber stopper with short glass tubing; rubber tubing with glass adapter to connect to Levin tube; rubber tubing to connect to long glass tube in Bottle No. 1.



1 Three-bottle
2 Two-bottle

Figure 133. Improvised suction drainage apparatus.

(4) An IV standard.
(5) A clamp on each piece of rubber tubing.

b. Preparation of the Patient. Explain the procedure to the patient.

c. Setting Up the Equipment at the Bedside.

(1) Close all clamps.
(2) Invert and hang Bottle No. 1 on the IV standard; place Bottle No. 2 and Bottle No. 3 on the floor.
(3) Connect the glass connector to the Levin tube already in place in the patient.
(4) Open all three clamps.

(*Explanation of Suction.* Water flows from Bottle No. 1 to Bottle No. 2, creating a partial vacuum in Bottle No. 1. Air flows from Bottle No. 3 to Bottle No. 1 to fill the partial vacuum. This creates a partial vacuum in Bottle No. 3. The contents of the stomach are then withdrawn to fill partial vacuum in Bottle No. 3.)

d. Care of the Patient During Treatment. This care is the same as that described in paragraph 440*e*.

e. Care of Apparatus During Procedure.

(1) When Bottle No. 1 becomes empty, close clamp between Bot-

tle No. 1 and Bottle No. 3. Change positions of Bottles No. 1 and No. 2. Open clamp.

(2) Empty drainage bottle, Bottle No. 3, when ⅔ full and every 12 hours or according to the standing operating procedure of the ward.

(*a*) Close clamps on tubing to Bottle No. 1 and to the Levin tube.

(*b*) Remove the rubber stopper; allow it to rest in the emesis basin.

(*c*) Measure and note the contents of the bottle.

(*d*) Wash the bottle well.

(*e*) Replace the bottle; open the clamp.

(3) Observe the suction frequently, report if it is not working properly.

(4) Irrigate the Levin tube.

(*a*) Indications—when ordered by the doctor.

(*b*) Equipment—

1. Basin with warm water or saline solution.

2. Bulb syringe.

3. Emesis basin.

(*c*) Procedure—

1. Close the clamp on the tubing from the Levin tube—drainage Bottle No. 3.

2. Place the emesis basin under the connector of the Levin tubes and drainage tube.

3. Disconnect the tubing.

4. Fill the syringe; insert the tip into the Levin tube; gently force the solution into the tube.

5. Allow the solution to drain out of the tube into the emesis basin.

6. Repeat steps *4* and *5* until the return is fairly clear, or as ordered.

7. Connect the Levin tube to the drainage tube; unclamp the tubing.

8. Remove and clean the equipment.

f. *Discontinuing Suction.*

(1) Discontinue suction on order of the doctor.

(2) Close the clamp on the tubing leading from the Levin tube to Bottle No. 3.

(3) Disconnect the Levin tubes and the glass adapter.

(4) Remove the tube, if ordered.

(5) Make the patient comfortable.

g. *Care of Equipment.*

(1) Remove all equipment to the utility room.

(2) Measure and record drainage.

(3) Clean all equipment well.

(4) Return equipment to the Centralized Materiel Section or store it in the proper place.

445. Hand Pump Method (Phelan Pump)

In this method a partial vacuum is created by pumping some air out of the tank.

a. Equipment.

(1) Phelan pump.

(2) Gallon drainage bottle with a 2-hole rubber stopper and two short pieces of glass tubing.

(3) Two pieces of rubber tubing, each about 4 feet long. One piece of the tubing is connected from the pump to the drainage bottle; the other piece connects the patient's Levin tube to the drainage bottle.

(4) Glass connecting tip.

(5) Rest of equipment as noted in paragraph 443*a*.

b. Procedure for Connecting the Apparatus.

(1) Connect the two pieces of tubing to the rubber stopper.

(2) Insert the rubber stopper into the drainage bottle. The stopper must fit tightly, or there will be no suction.

(3) Connect one piece of the tubing to the gauge on the tank.

(4) Connect the other piece of tubing to the patient's Levin tube (by means of the glass connecting tip).

c. To Start Siphonage.

(1) Open the valve on the tank by turning the knob in a counterclockise direction.

(2) Create suction in the tank by pumping about 40 or 50 strokes, until the gauge registers 5. If all the tubing is free from leaks, this suction will last for about 20 hours.

d. Care of the Patient During Treatment (as described in paragraph 440*e*).

e. Care of Equipment During Treatment. Watch the gauge. The dial should read 3 to 5.

446. Electric Pump Method

This method uses a motorless pump, which exerts intermittent suction (fig. 134). The pump is connected to a drainage bottle and to the patient in a manner similar to that described for the operation of the Phelan pump. Follow the specific directions on the pump. Care of the patient is the same as described in paragraph 440*e*.

447. Intestinal Decompression

This procedure is a variation of the gastric suction procedure. It is accomplished by means of the Miller-Abbott tube, which has a small balloon at its tip and a double lumen. The larger lumen is used for drainage with the Wagensteen apparatus; the smaller

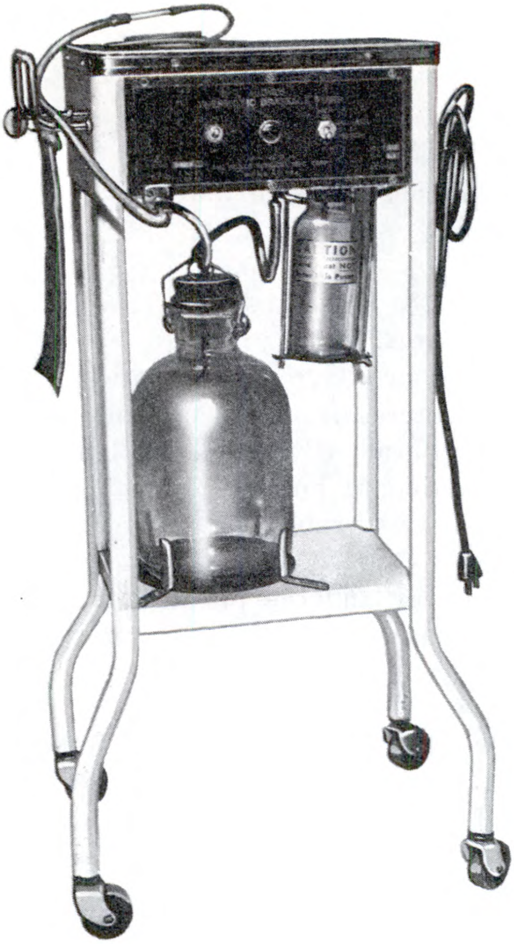


Figure 134. Electric drainage apparatus.

lumen is used to inflate and deflate the balloon after the tube has been passed through the nose into the stomach. When inflated, the balloon is carried through the intestine by peristaltic action, drawing the tube after it. Suction drainage keeps the intestine empty of fluid and gas behind the tip of the tube. To remove the Miller-Abbott tube, the balloon must be deflated. Regardless of how far the tube has been allowed to pass, it can be withdrawn easily.

448. Gastric Lavage

a. General. In cases of poisoning, acute alcoholism, some types of indigestion, or obstruction of the pylorus, it is sometimes necessary to wash out the stomach. A stomach tube is used for this procedure, as a large lumen is needed to pass particles of food. The doctor usually passes the tube, but may order that the specialist do it.

b. Equipment.

(1) Tray containing—

(*a*) Stomach tube in a basin of ice. (Do not ice if tube is plastic.)

(*b*) Rubber sheet and cover.

(*c*) Emesis basin.

(*d*) Paper wipes.

(2) A large pitcher of warm water or the solution ordered by the doctor.

(3) A bucket.

c. Preparation of the Patient.

(1) Screen the area.

(2) Explain the procedure to the patient.

(3) Remove dentures from the patient's mouth.

(4) Elevate the head of the bed until the patient is in semi-sitting position, if possible.

(5) Place the covered rubber sheets over the bedding and under the patient's chin.

(6) Place the tray and the pitcher of water in a convenient position. Place the bucket for returns on the floor.

d. Procedure.

(1) Pass the tube.

(*a*) Remove the tube from the ice. Lubricate it by dipping it in a saline solution or by wiping it with a bit of gauze dipped in lubricating jelly.

(*b*) Estimate the distance the tube will be inserted. (Measure on the tube the distance from the tip of the nose around the ear and to the lower end of the sternum.)

(*c*) Hold the tube six inches from its tip and rotate it until you determine the position of greatest droop. Ask the patient to tilt his head slightly backward.

(*d*) Place the tip of the tube far back in the patient's mouth.

(*e*) Request the patient to swallow; each time he swallows, insert the tube a few inches.

(*f*) Avoid the use of force. Observe the patient for coughing, choking, or cyanosis. If any of these symptoms occur, *remove the tube quickly* and allow the patient to rest before reinserting tube.

(2) Check for the position of the tube to make sure it is in the stomach, not in the trachea, as explained in paragraph 440*e*.

(3) Wash out the stomach.

(*a*) Lower the head of the bed; have the patient lie on his side, with his mouth near the edge of the bed.

(*b*) Lower the funnel over the bucket (much of the stomach contents will drain).

(*c*) Collect a specimen at the time, if ordered.

(*d*) Hold the funnel upright, pour the solution into the funnel and keep it full until approximately 500 cc. have been given.
(*e*) Invert the funnel while there is still some solution in it; allow it to drain.
(*f*) Repeat (*d*) and (*e*) above until the returns are clear or until the amount ordered has been used.

(4) Observe the patient.
(*a*) General: Pulse, respiration, color, signs of fatigue.
(*b*) Stomach washings: General appearance, odor, color, presence of blood.

(5) Discontinue treatment.
(*a*) Pinch the tube at patient's lips to prevent the contents from spilling into trachea.
(*b*) Withdraw the tube smoothly and quickly; place it in an emesis basin.

(6) Make the patient comfortable; leave the unit in order.
(*a*) Remove the rubber sheet and cover.
(*b*) Change linen, if soiled.
(*c*) Assist the patient to rinse his mouth.
(*d*) Bathe the patient's face.

e. Care of Equipment.
(1) Remove to the utility room.
(2) Measure the returns, if requested.
(3) Discard the soiled linen; wash the rubber sheet.
(4) Wash the tube; take special care to clean the inside of the tube thoroughly. Follow the standard operating procedure of the hospital for disinfecting the tube. Plastic tubes are discarded after use.
(5) Restock the tray.

f. Record the Procedure.
(1) Times, type, amount of solution used.
(2) Amount, appearance, and odor of returns.

449. Gavage

a. Tube feeding. Tube feeding is required to give nourishment or drugs to those who will not or cannot take them otherwise. Only liquids may be given in this manner. A Levin tube or a nasal feeding tube is used in this procedure. The nasal feeding tube is smaller but similar to the stomach tube, with a rounded tip and a funnel or graduated flask at its upper end. If a Levin tube is used, the cylinder of a 30-cc. syringe may be used as a funnel.

b. Equipment.
(1) Levin tube in a basin of ice.
(2) Rubber square and cover.
(3) Safety pin.

(4) Water-soluble lubricant.
(5) Asepto syringe.
(6) Small pitcher with water (at approximately body temperature).
(7) Feeding (warmed to body temperature), as ordered by the doctor and prepared by the food service.

c. Prepare the Patient.

(1) Screen the area.
(2) Explain the procedure to the patient (for first feeding only).
(3) Place him in a sitting or semisitting position, if it is permitted.

d. Procedure.

(1) Pass the tube as described in paragraph 483.
(2) Check the position of the tube.
(3) Attach the barrel of the syringe to the tube.
(4) Feed the patient.
 (*a*) Slowly pour the fluid down the side of the syringe.
 (*b*) Keep the syringe full until all of the food mixture has been given. Do not give the food too rapidly as it may cause distention of the stomach and vomiting. Always allow the solution to run in by the force of gravity alone. Do not force the feeding by placing the plunger in the syringe cylinder.
(5) Rinse the tube by pouring in about 60 cc. of water.
(6) Remove the tube by pinching it off and withdrawing it with a single smooth movement. (Sometimes the tube is left in place if the patient is to continue having tube feedings. If it is, cover the end of the tubing with a gauze square and clamp the tubing.) Give care of mouth and nose as described in paragraph 440.
(7) Make the patient comfortable.
(8) Remove and clean the equipment.

Section II. ASSISTING WITH DIAGNOSTIC TESTS

450. General

A number of diagnostic tests are performed on the wards and in the various clinics. Although the specialist seldom performs the tests, he should be acquainted with them in order to assist the doctor, the nurse, or the laboratory specialist. The specialist's role in the procedure usually includes the following: preparation of the patient; preparation of the equipment; patient care before, during, and after the procedure; collection of specimens, and care of equipment following the procedure. The specialist should know how and why the

procedure is done and the reactions to be expected from it. The specialist may be asked to label specimens, transport them to the laboratory, and then record the findings on the patient's chart.

451. Preparation of the Patient

Since many of these diagnostic tests depend for their success upon the cooperation of the patient, it is necessary for him to have some understanding of the tests, so that he can do everything possible to assist with the test and will accept the discomfort involved. The patient should be reassured that the test is necessary and that it will help in his diagnosis and eventual recovery. Provide transportation (wheelchair or stretcher) to the designated place, if the test is not to be done on the ward. Hold his breakfast or omit it, if it is so indicated. Give enemas before tests, if ordered. Be sure that the patient gets rest and is not unnecessarily disturbed.

452. General Rules for Collection of Specimens

a. The "Nine Rights." In collecting the specimen, the specialist should remember the "Nine Rights:"

(1) The right specimen from
(2) the right patient, collected in
(3) the right manner, at
(4) the right time, into
(5) the right container, in
(6) the right amount, and with
(7) the right label, is taken to
(8) the right place in the laboratory, and handed to
(9) the right person.

b. Sending Specimens to the Laboratory. Containers with specimens are usually labeled with the name and the ward number of the patient and the type of specimen. The correct laboratory slip is made out in duplicate indicating the type of examination required. The specimen and laboratory slips are sent to the laboratory where the examination is made. One slip is filed in the laboratory and the other is sent back to be put in the patient's chart after the ward officer has seen and initialed it. When a sterile specimen is requested, it is collected in a sterile bottle with sterile technique.

453. Collection of Urine

a. General. The examination of urine is one of the most frequently made tests. The specimen is usually collected on the ward. Since the composition of the urine varies during the day, the doctor often requests that specimens be collected at different hours so that he may get a more accurate picture of the patient's condition. A *single specimen* is the urine passed in one voiding. For a *24-hour urine specimen* all urine passed by the patient in a period of 24 hours is saved.

b. Taking a Single Specimen. If possible, have the patient void directly into the clean urine bottle. Collect at least four ounces. If the patient is a bed patient, you may have to collect the specimen in a clean urinal to avoid soiling the sheets and then transfer it to the specimen bottle. If a sterile specimen is requested, the patient must be catheterized and the bottle must be sterile. The specimen must be clearly marked with the patient's name and ward number, the date, and the tests desired. Since the urine should be examined while it is fresh, send the specimen at once to the laboratory. It is usually tested for alkalinity, specific gravity, urinary sediment, and for the presence of albumin, sugar, and glucose.

c. Collecting a 24-hour Specimen. If a "24-hour urine specimen" is to be collected, use a large clean jar and keep it in a cool place during the 24-hour period. Formalin is added as a preservative. Ten to 15 drops are measured into the large jar before the specimen is collected. Any 24-hour period may be selected, but it is best to start at 0800 hours and collect the specimen until 0800 hours the following day. To collect all urine produced by the kidneys during the 24-hour period, have the patient void at 0800 the first day. Discard this urine so that the patient will start the test with an empty bladder. Save in the large jar all urine passed for the next 24 hours (up to and including 0800 hours the second day). Collect the last specimen exactly 24 hours after the start. Send the whole specimen to the laboratory, indicating on the laboratory slip that it is a 24-hour collection. It is then tested for the total normal constituents or waste products normally eliminated by the kidneys, the specific gravity, the ashes of protein metabolism, inorganic salts, hormone excretion products, and total abnormal constituents.

454. Collecting Sputum

Sputum is material that comes from the lungs. It is not saliva, which is a mouth fluid. Sputum specimens must always be collected into clean containers. Tell the patient to clear his mouth by spitting out all saliva. Then instruct him to cough up sputum from "deep down" in the lungs, and to clear the sputum from the back of his throat directly into a screw-top, wide-mouth glass jar, without touching the mouth of the bottle with his lips. (Try to get at least a teaspoonful of sputum for the specimen.) Cap the bottle securely. Prepare the appropriate form indicating the examination requested by the ward officer. Send the specimen, properly labeled, to the laboratory at once.

455. Examination of the Feces

a. A microscopic examination of feces often verifies an examination made by gross observation for pus, intestinal parasites, blood,

fat, and starch. Tests for bacteria may be made to determine typhoid carriers, or to ascertain the presence of paratyphoid bacilli.

b. The amount of feces required for examination is usually small; occasionally the whole stool may be saved for examination. For an examination for parasites and ova, use a clean tongue depressor to pick up from the bedpan a mass of feces about an inch across. Deposit the feces in a clean, small, wide-mouthed container, or a covered wax paper cup, being very careful not to get any of the specimen on the outside of the container when you are transferring it. Avoid having the specimen mixed with urine by having the patient void into one pan first and then replacing that pan with a clean one before the feces is passed. Replace the cover and send it at once while warm to the laboratory along with the appropriate form prepared in duplicate.

c. Further bacteriological studies of feces require a sterile stool specimen, which is collected by a laboratory specialist.

456. Tests of Vomitus

If the doctor requests an examination of vomitus, transfer it from the basin into which the patient has vomited to a clean wide-mouth jar. Collect 120 cc. if possible. Cover the jar and label it properly. Send it promptly to the laboratory with appropriate forms, stating the examination requested.

457. Blood Tests

a. General. Blood specimens for laboratory examination are usually collected by laboratory personnel, but in an emergency, the specimen may be obtained by experienced medical specialists on the ward. If the patient is ambulatory, he usually is taken to the laboratory for the collection; if he is a bed patient, a laboratory specialist comes to the ward. The appropriate laboratory request form, which is always prepared in duplicate, must include a clear statement of the examination desired by the doctor. Examples of blood tests are hematology tests [WBC (white blood count), RBC (red blood count), and hemoglobin] coagulation and bleeding time tests, sedimentation rate, typing, cross matching, blood chemistry, and serology tests.

b. Serology. Blood for serology tests (such as the Wassermann or Kahn) is usually taken by venipuncture (fig. 135). Place a tourniquet, snug but not tight, on the arm above the elbow. Insert the needle of a sterile syringe into a vein and draw into the syringe the amount of blood desired. Transfer the blood to a sterile test tube. Always remove the tourniquet before you withdraw the needle. The usual amount of blood is 10 cc. Stopper the test tube and send it to the laboratory at once, accompanied by appropriate forms. This blood will clot in the test tube, but a clot is desired for the serology test.

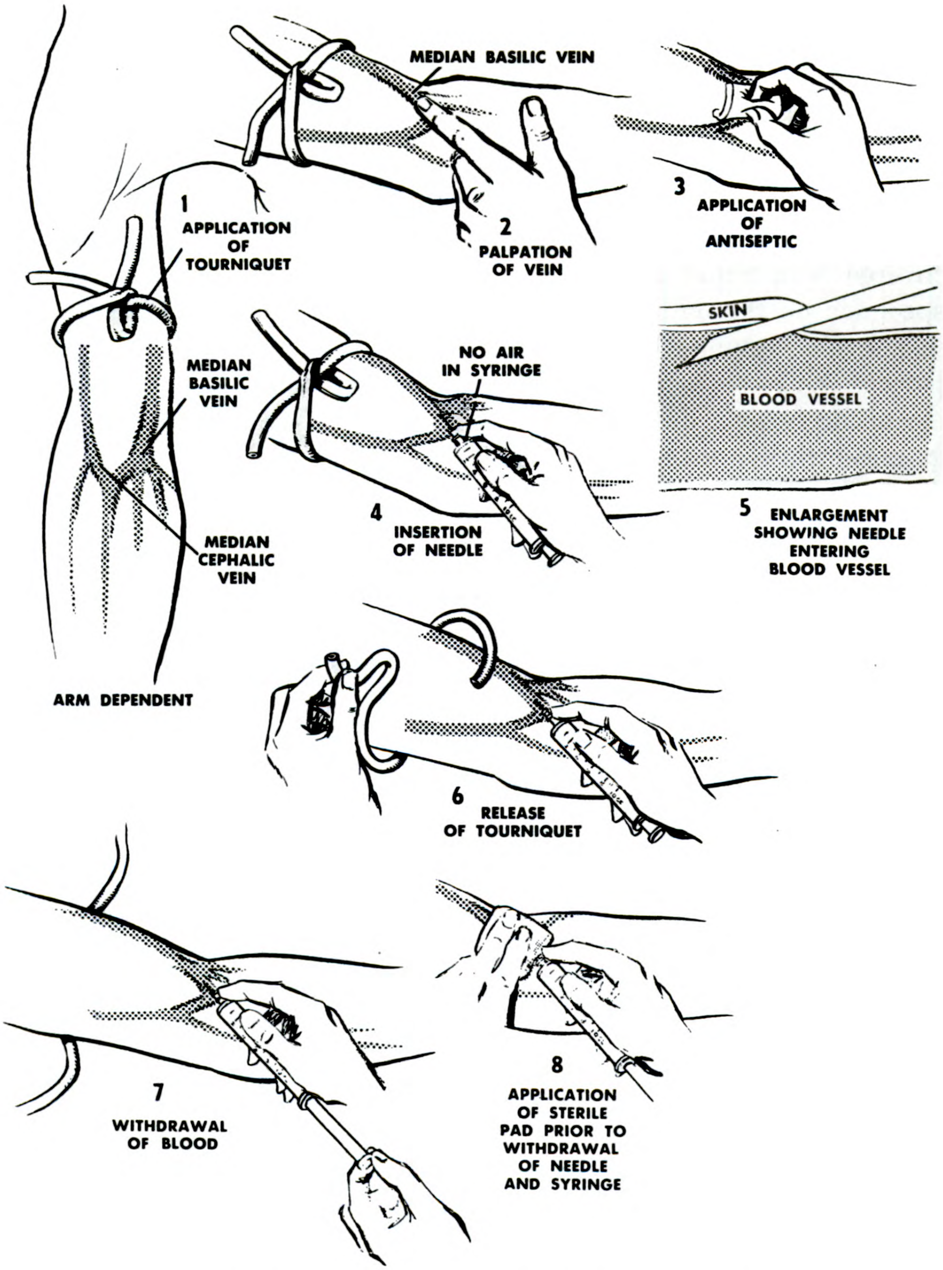


Figure 135. Collecting blood by venipuncture.

c. Blood Culture. Cultures of blood are made to determine the presence of bacteria and must be taken under strictly aseptic conditions. Use a sterile cotton-stoppered test tube to receive the blood. In some cases the blood is injected directly into a culture plate where it comes in contact with culture media and is incubated. Sometimes the culture must be observed over a period of time. Typhoid bacilli, pneumococci, staphylococci, and streptococci are some of the organisms that may be determined by means of blood culture.

d. Blood Chemistry. Unclotted blood is necessary for blood chemistry tests. It must be collected in a 10 cc. syringe, as for serology (*b* above) and transferred at once to a small glass bottle containing a few crystals of sodium oxalate or citrate to keep the blood from clotting. Blood specimens are usually taken in the early morning since many of the tests require that the patient be in a fasting state.

e. Blood Smear. Wipe off the tip of the middle finger or the ear lobe with alcohol and stab it with a disposable lancet so that a drop of blood appears on the skin surface. Touch one end of the flat surface of a glass slide to the drop so that the blood is transferred to the slide. Hold another glass slide at a 45° angle to the first one and place it in the drop of blood. Next, draw the top slide across the bottom one and smear the drop of blood all along the flat surface (fig. 136). Spread the blood rapidly to give a thin film; slow spreading leaves a thick film. In a few minutes the blood will dry and is ready to be sent to the laboratory. Wrap the appropriate laboratory request slips around the slide and tie them.

458. Smears and Cultures

a. Smears. Smears may be made of blood (par. 457), pus, or other body fluids or discharges. They may be taken from the eyes, ears, nose, throat, urethra, and vagina. Smears are stained in the laboratory and then examined microscopically for bacteria. To make

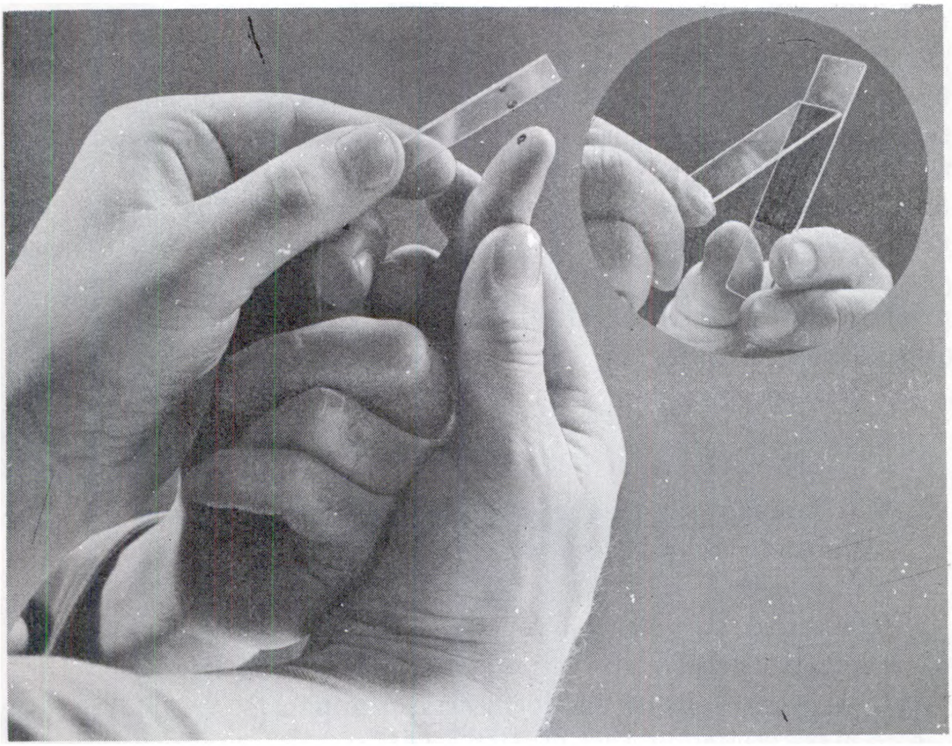


Figure 136. Making a blood smear.

a smear of pus, dip a sterile applicator into the pus and draw it across the flat surface of a clean glass slide. Let the smear dry for a few minutes before wrapping the slide and sending it to the laboratory.

b. Cultures. Secretion or material from a wound, from the skin, or from any mucous surface may be transferred to a medium (sometimes called the *broth*) which encourages the growth of microorganisms. By thus speeding up their growth, a laboratory specialist can make a study to determine the presence of many types of bacteria. Use a sterile stoppered test tube and a sterile swab. Remove the stopper and swab with one hand, wipe the applicator over the surface to be cultured and immediately reinsert the applicator in the test tube without allowing it to touch anything else. Forward with the proper forms *immediately*. Promptness is imperative. In some cases the applicator is inserted immediately into a test tube containing the broth. After the test tube is plugged carefully with cotton, the contents are subjected to conditions which favor the growth of the suspected organisms.

459. Function Tests

There are also tests which determine the malfunction of certain body systems, such as the liver and kidneys, and the basal metabolism rate. Before any of these tests the patient must be given a complete explanation as to what the test is for, how it is to be made, and how to prepare for it.

a. Liver Function Test (BSP). In this test a dye is administered by the doctor, and at a specified period afterwards a blood sample is taken by a laboratory specialist. The test measures concentration of the dye in the blood and determines what percentage of the dye the liver has removed from the blood and excreted. The specialist is responsible for seeing that the doctor's orders are carried out in regard to allowing the patient nothing by mouth after 2400 hours prior to the test. He is also responsible for having the following equipment ready:

1 syringe, 30 cc.
1 syringe, 10 cc.
2 needles, 20 G, 2″
Skin preparation tray
Ampoules of bromsulphalein (BSP) dye (obtained from the pharmacy)
1 test tube, acid cleaned (obtained from the laboratory)
1 gummed label with the patient's name, ward, date, test
Liver and Biliary Function Form in duplicate

b. Kidney Function Test (PSP). This test is performed to measure the functional capacity of the kidneys by making a quantitative

measurement of the amount of phenolsulfonphthalein (PSP) dye eliminated within a stated time. Have ready the following equipment:

4 urine specimen bottles
1 specimen bottle containing 4 cc. of sodium hydroxide 10%
Skin preparation tray
1 syringe, 2 cc. or tuberculin
1 needle, 20 G, 2″
1 ampoule PSP dye
4 gummed labels with patient's name, ward, date, test, hour, and specimen number
Renal Function Standard Form in duplicate

The patient voids and is then given three glasses of water to drink within 20 minutes. Ten minutes after the patient has finished drinking the water, the doctor injects 1 cc. of the dye intravenously. Exactly five minutes after the injection, instruct the patient to void a *very small amount* of urine in the unlabeled bottle containing the 4 cc. of sodium hydroxide. Record on the laboratory slip whether or not a red color is produced. Save this "appearance" specimen to add to specimen No. 1 when it is collected. Collect urine specimens at the following intervals after the injection of the dye:

Specimen	No. 1------	15 minutes
	No. 2------	30 minutes
	No. 3------	60 minutes
	No. 4------	120 minutes

Record on the Standard Form the time the dye was injected and the exact time each specimen was collected. Send the specimens to the laboratory with the request slips.

c. Basal Metabolism Test. This test is usually given in the Basal Metabolism Section. It determines the rate of absorption of oxygen by the blood from the lungs under basal conditions (i.e., when the body is at rest). The patient is usually given a light supper on the evening prior to the test. Record his height and weight at 2000 hours and have him in bed by 2100 hours. Withhold food, fluids, and smoking after 2100, but allow bathroom privileges until 2400 hours. Do not disturb the patient till time for the test. Then take TPR and record them on the standard form. Transport the patient, if necessary, to the BMR Section.

460. Gastric Analysis

Gastric analysis is usually done if tuberculosis is suspected or to determine the percentage of acid content if there is indication that ulcers may be present. Diet is withheld or regulated before and during the test and specimens are collected at specified times. The specimens for examination of the contents of the stomach are secured

by passing a Levin tube into the stomach (par. 440). Specimens are obtained by attaching a 30 cc. syringe to the Levin tube and withdrawing about 10 cc. of the stomach contents. The specimen is then placed in a specimen bottle, properly labeled, and sent to the laboratory for analysis. Test meals are often given in connection with the tests and the contents of the stomach aspirated each 15 minutes for two hours after the patient has eaten the meal. Label each indvidual specimen carefully to make sure the course of the gastric secretions will be correctly observed and tested. The speed with which food goes through the stomach is also often tested in this manner.

461. Lumbar Puncture (Spinal Tap)

a. General. A lumbar puncture is the insertion of a needle into the spinal canal. It is performed to withdraw fluid for diagnosis, to administer medication, to determine spinal fluid pressure (manometric test), to inject dye or fluids for an X-ray (called a myelogram), or to inject air or oxygen (a *pneumoencephalogram*).

b. Equipment. A prepared sterile tray containing—

(1) Two medicine glasses (one for merthiolate to paint the area and one for the local anesthetic).
(2) Forceps with a sponge for painting the area.
(3) Towels and drapes.
(4) Hypodermic needle and syringe for anesthetizing the area.
(5) Spinal puncture needles as desired.
(6) Stylet.
(7) Three-way stopcock.
(8) Spinal manometer.
(9) Three test tubes with corks.
(10) Syringe (10 cc.) for use if medication is to be injected into the spinal canal.

c. Preparation of the Patient. The patient must have the procedure explained to him. He must lend his cooperation by remaining motionless during the treatment. He should also be warned that the insertion of the needle is usually somewhat painful as the local anesthetic rarely reaches the meninges. Shave the lumbar region if necessary. Place the patient on his side with his back even with the side of the bed. Ask him to arch his back, to draw his knees up toward his chin, to move his shoulders forward, and to place his chin on his chest. Standing at the side of the bed toward which he is facing, support and hold him in position. The doctor will be on the other side. While holding the patient, encourage him to relax and breathe through his mouth (fig. 137).

d. Procedure. After the doctor prepares the site with merthiolate and drapes the patient, he will anesthetize the area and insert the lumbar puncture needle into the spinal canal. As soon as the spinal

Figure 137. Lumbar puncture.

fluid begins to drop from the needle, the doctor attaches the manometer tube to the spinal needle. At this point he will probably ask you to compress the jugular vein on both sides of the patient's neck and to relase the veins on signal after 10 seconds. Write down on a pad the results the doctor announces. He will then fill the specimen tubes with the spinal fluid and hand them to you. These tubes should be properly labeled in sequence and sent promptly to the laboratory with the appropriate forms. When the needle is withdrawn, apply a sterile dressing to the puncture site. Make the patient comfortable. Chart the time, character, and amount of spinal fluid withdrawn and any unusual reaction. The spinal fluid, when normal, is clear and colorless. Clean and return all equipment.

462. Care of the Patient After Tests

One of the most important contributions you will make to the diagnostic testing procedures is the care of the patient *after* the test. Always see that he is in a comfortable position. Observe him closely for any pain or discomfort. If his last meal has been withheld, heat it and serve it to him as soon as possible. If enemas or any other treatments are ordered following the test, administer them and record on his chart. Reassure him and then let him rest.

Section III. ADMINISTRATION OF MEDICATIONS

463. General Principles

Administration of medications is an essential part of patient care. The purpose of medication may be preventive, curative, or alleviative (for relief of pain or discomfort). Medicine may be administered in many different forms or through many different channels (pars. 466–473), but the same general principles must be followed with a strictness which does not allow for even the first error. For the best results the drug must be given *exactly* as the doctor has prescribed: method or channel of administration, preparation, time, and dosage. Reactions must be observed and reported. If you as a specialist understand why the drug was ordered, what result the doctor hopes to get, the signs of the intended effect, and the signs of an overdose or of accumulative toxic effect, you can be of great assistance to him and contribute much toward the patient's recovery. You should know the maximum and minimum dosage of the drugs used on the wards and you should be acquainted with the effects that different kinds of drugs have on the body systems (ch. 5).

464. Responsibility of the Specialist

Although it is the responsibility of the doctor to prescribe the medication and the responsibility of the nurse to give it or see that it is given, it is the specialist's responsibility to follow orders intelligently and with a constant awareness of variations which occur sometimes in procedures and of reactions of patients to drugs. The specialist must remember to check thoroughly several factors when he is asked to administer drugs. First, be sure that you have the right drug for the right patient. Call the patient by name or check his bed card before administering the drug. Second, check again the amount prescribed, and do not hesitate to check with the nurse if, according to your knowledge of maximum dosage, the amount prescribed seems excessive. Third, observe proper techniques in pouring and preparing drugs (par. 466). Fourth, administer the drug *exactly as specified* and *exactly at the time designated* by the doctor. Fifth, stand at the patient's bedside until he has swallowed the medicine. Never leave the medication for him to take by himself. Sixth, always record the medication on the nurse's notes. Seventh, observe the patient closely for any signs of unfavorable reactions, and report them at once to the nurse.

465. Use of Medicine Cards

Routine medications are written on medicine cards which contain the patient's name, medication, and dosage, and the hours of administration. At least once every 8 hours the doctor's orders are checked

against these cards. The cards are kept in a file according to the hours of administration. At the beginning of each hour, the cards for that hour are removed from the file and arranged face up on a tray or cart. A medicine glass is placed on each card which calls for liquid medications, and the appropriate dose of liquid medicine placed in each glass. Pills and capsules are placed in a paper cup. The medications are then carried on the tray or the medicine cart to the patient's bedside. After the medications are administered, the medicine cards are placed in the file according to the hour of the next medication. Medication such as injections, external applications, and enemas are not administered in this manner, but must be accomplished individually.

466. General Rules for Preparation of Oral Medications

a. Never use drugs in unlabeled containers.

b. Read the label *three times.*

c. Shake liquid medicines before pouring.

d. Pour liquid medicines from the side of the bottle away from the label so that if a drop runs down the outside of the bottle, it will not obscure the label.

e. Measure the dosage accurately.

f. Allow no distractions while preparing medications.

g. Never pour medicines back into the bottle.

h. Wipe off the necks of the bottles containing liquids before replacing the corks.

467. Oral Administration of Drugs

a. Observe carefully the general rules for the preparation and administration of medications (par. 466).

b. Use a graduated medicine glass to measure liquid medicines.

c. Use a medicine tray or cart to carry the medications and the medicine cards to the patient's bedside.

d. All medicines are followed by water to increase their absorption, unless the medical officer orders otherwise. Cough medicine and tablets to be dissolved in the mouth are exceptions to this rule. Have the patient drink freely before taking a cough mixture and do not let him drink for at least a half hour afterward.

e. Before giving a drug with a disagreeable taste, let the patient hold ice chips in his mouth to anesthetize the taste buds of his tongue.

f. The best way to give castor oil is to put the dose in a half glass of orange juice. At the patient's bed add a quarter or half teaspoonful of baking soda (sodium bicarbonate). Administer while fizzing.

g. A powder, if small, is placed on the back of the tongue and washed down with water. If large, stir in a glass of water and have the patient swallow it before it settles in the glass.

468. Subcutaneous Administration (Hypodermic)

a. General. The injection of small amounts of liquid (2 cc. or less) into the lose, fatty tissues just under the skin is commonly called a hypodermic injection. It is a common way to administer medicine for rapid and immediate effect, and is often used when drugs cause irritation of the gastrointestinal tract, when drugs taken orally are ineffective, or when the patient is unable to take medications by mouth. When a patient is nauseated, is vomiting, is unable to swallow, or is unconscious, the needle injection method is the method of choice. The fluid is quickly carried by the lymph stream to the bloodstream and the full effect is usually felt within 20 to 30 minutes. This method is most commonly used for administering narcotics, sedatives, and immunizing materials.

b. Preparation of Equipment.

(1) Have ready the following equipment on a hypodermic tray: a sterile container of alcohol sponges, a sterile transfer forceps in a sterile container of antiseptic solution, a sterile, wrapped 2 cc. syringe with needle, a vial of normal saline, a box of emergency drugs, an ampoule file, and a waste receptacle.

(2) Prepare the syringe as follows:

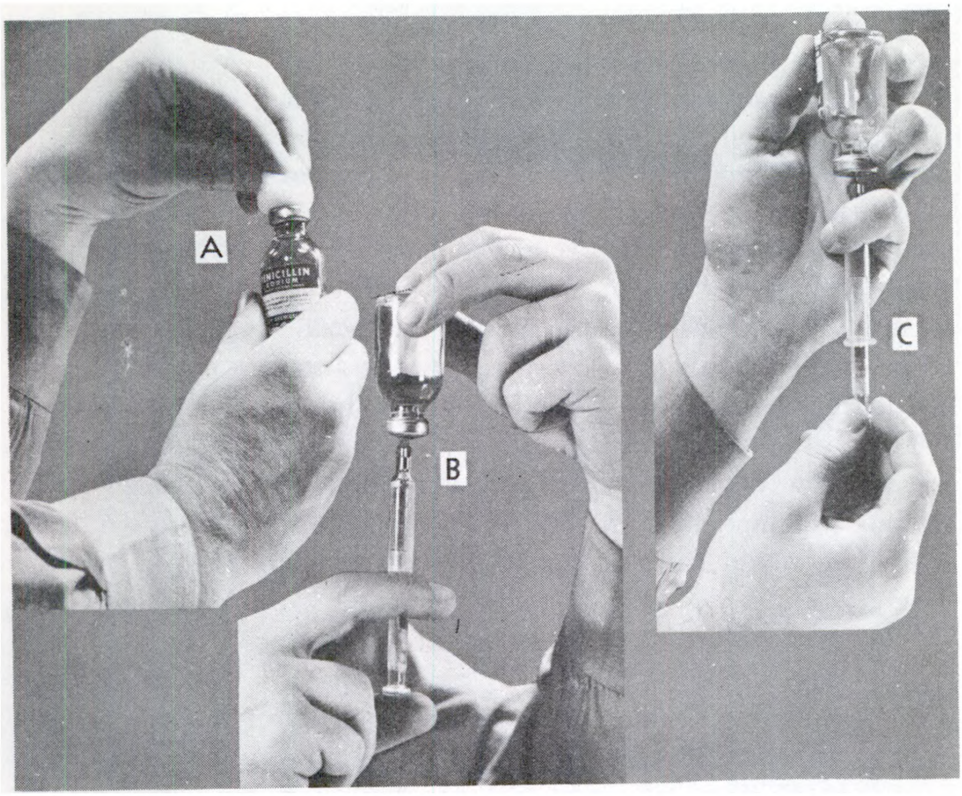
(*a*) Assemble the sterile needle and syringe, being careful not to contaminate the needle or the inner part of the barrel and plunger of the syringe.

(*b*) Draw back the plunger to the point on the scale which indicates the amount of liquid you are going to use. This space in the barrel will, of course, fill with air.

(*c*) Holding the vial upside down, insert the needle through the stopper (which you have previously wiped off thoroughly with alcohol) and inject the air from the barrel of the syringe into the vial.

(*d*) Withdraw the prescribed quantity of the solution. The injection is now ready to administer (fig. 138).

c. Procedure in Giving Hypodermic Injection. The sites of injection most commonly used are the outer surface of the upper arm or the outer aspect of the upper thigh. Prepare the skin by applying an alcohol sponge in a spiral motion beginning at the site of the injection and continuing outward until an area three inches in diameter has been prepared. Insert the needle quickly (with the bevel up) about a half inch under the skin at an angle of about 45° (fig. 139). Aspirate slightly with the plunger to test if the needle is in a blood vessel. If any blood appears in the syringe, withdraw the needle and give the injection in another place. If no blood appears in the syringe, press the plunger slowly to expel the drug into the tissues. Cover the injection site with an alcohol sponge



A. Sterilizing stopper
B. Injecting air into vial
C. Withdrawal of solution from vial

Figure 138. Withdrawal of solution from sealed vial.

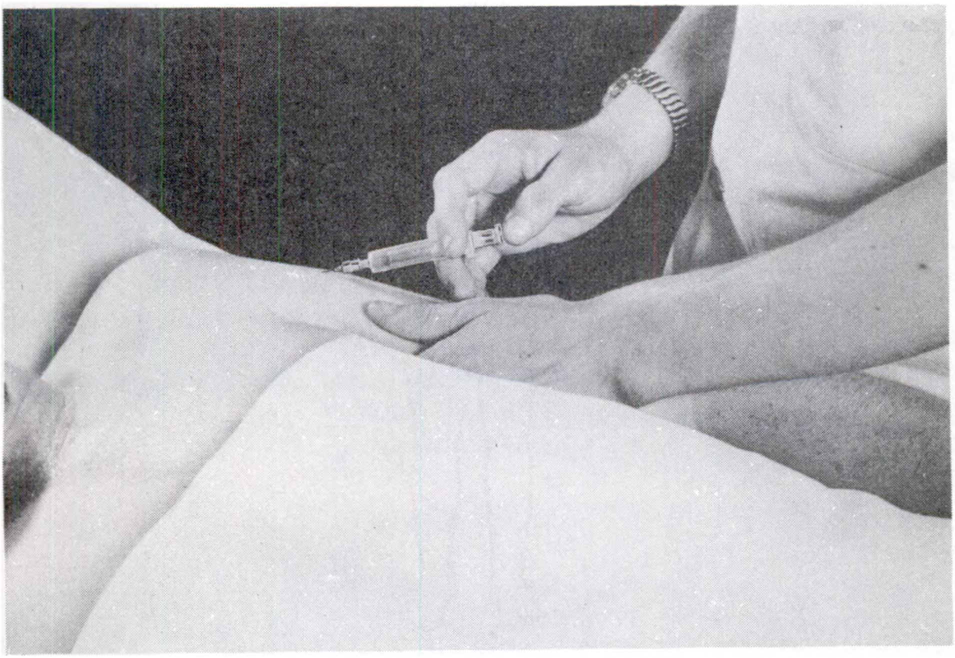


Figure 139. Administering a hypodermic.

and quickly withdraw the needle and syringe. Press the alcohol sponge firmly over the injection site for a few seconds. Rinse out the syringe and needle with water and send them back to the Centralized Materiel Section for sterilization.

d. Hypodermoclysis. This is the injection of a large amount of fluid, usually 1,000 cc. into the subcutaneous tissue by means of a needle whenever the intravenous method cannot be used (for example, collapsed veins or veins which are too small—like those of infants). It is usually injected into the subcutaneous connective tissue of the lower lateral chest wall or the anterior or lateral aspect of the thighs (fig. 140). By injecting the fluid in two sites (usually 500 cc. in each site), a liter can be given in an hour's time, but the rate of flow depends on the patient's ability to absorb the fluid. Aseptic technique must be used throughout the procedure. A large, sloughing wound, difficult to heal, results from infection at injection sites.

(1) *Solutions.* The fluids most frequently used are the following:

(*a*) Normal saline (0.85 percent solution of sodium chloride in sterile water).

(*b*) Glucose (never over 5 percent solution in sterile water or saline).

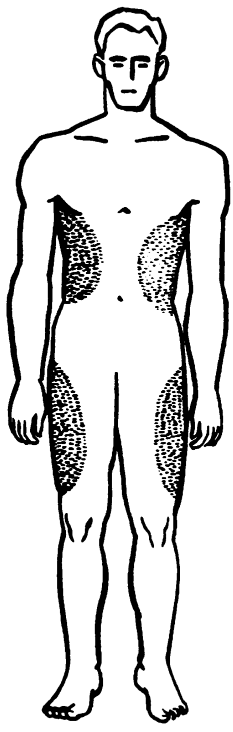


Figure 140. Areas of the skin used for hypodermoclysis.

(2) *Equipment.*

(*a*) Intravenous tray.

(*b*) Solution ordered.

(*c*) Hypodermoclysis set.

(*d*) Irrigating standard.

(3) *Hypodermoclysis technique* (fig. 141).

(*a*) After preparing the skin at the site of injection with merthiolate, drape the area with sterile towels, exposing only the prepared areas.

(*b*) Using aseptic technique, remove the drip device of the hypodermoclysis set and insert it into the stopper of the flask. Insert a 19-gauge needle into the air vent of the stopper and place a clamp on the tubing between the bottle and the Y connector. Hang the apparatus on an

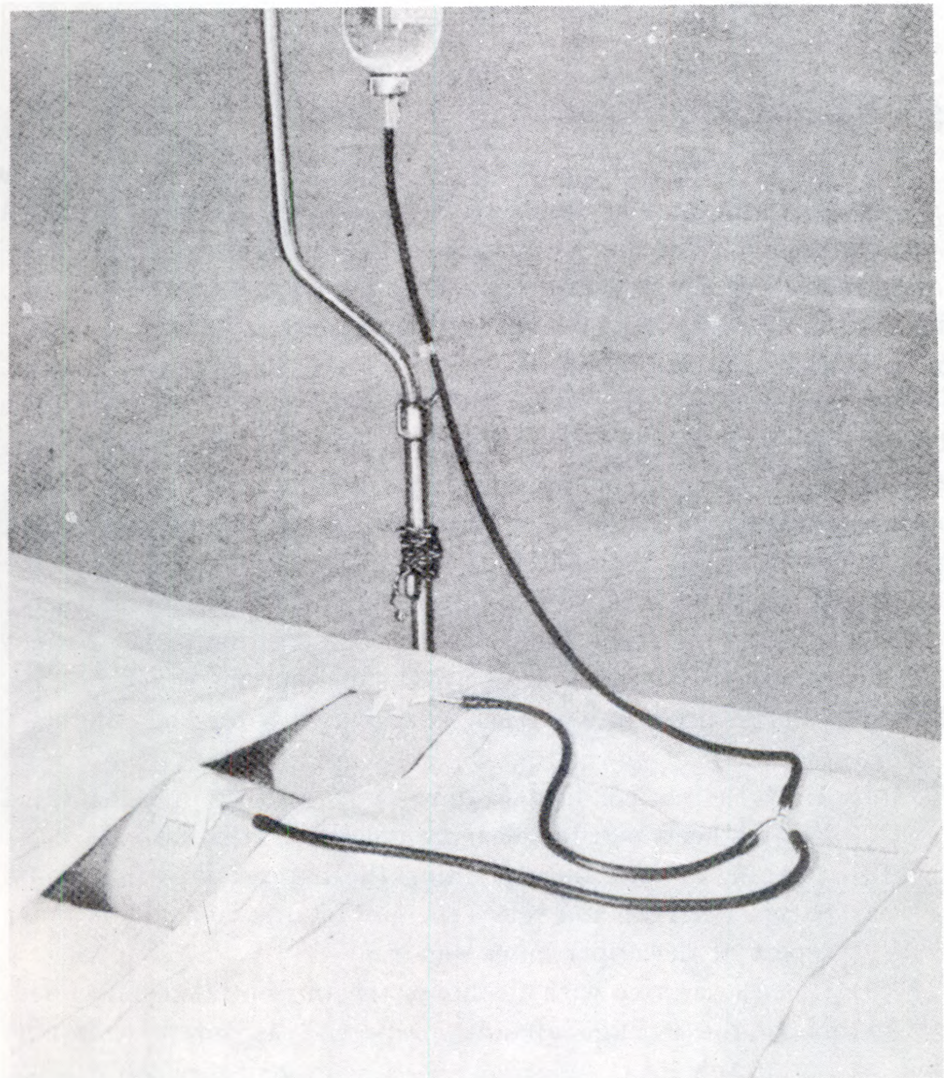


Figure 141. Hypodermoclysis being administered.

irrigating standard and expel the air from the system by allowing the solution to run through the tubing. Attach the needles and allow the solution to run through the needles.

(*c*) Insert the needles on each arm of the Y into the prepared areas of the skin, cover them with sterile gauze, and hold them in position with strips of adhesive. The tips of the needles lie in the loose subcutaneous tissue.

(*d*) Observe full aseptic precautions at all times.

(*e*) Watch the site of injection. If the area is blanched, firm to touch, and painful, stop the flow by clamping the rubber tubing, and massage the area gently in order to spread the fluid and hasten its absorption. Then loosen the clamp and regulate the flow again.

(*f*) When the solution has been given, clamp the tube, withdraw the needles, and cover the injection sites with small dressings.

469. Intramuscular Administration of Drugs

a. General. Drugs in quantities of from 2 cc. to 10 cc. may be injected into the muscles for the same reasons that they are given subcutaneously. The intramuscular route of administration is selected instead of the subcutaneous when the drug is irritating, when more rapid absorption is desired, and when there is a larger quantity of fluid than can readily be absorbed by the subcutaneous tissues. Since there is always the added risk of striking a nerve, a bone, or a large blood vessel, the site of injection must be chosen with care. The area in which the operator is least likely to hit bones, nerves, or blood vessels is the inner aspect of the upper outer quadrant of the buttocks (fig. 142) where the gluteal muscles are thick. Injections of small bulk, however, are often given in the outer aspect of the arm, or in the front of the thigh. The position of the patient and the procedure described below are the ones most frequently used. This is a sterile procedure. Wash your hands before starting.

b. Procedure.

(1) Have the patient lie face down with his toes turned inward and his heels out, to relax the muscles of the buttocks.

(2) Imagine crossed lines dividing the buttock into four equal parts (fig. 142) and select the site of injection in the inner aspect of the upper outer quadrant.

(3) Cleanse the area with alcohol or the antiseptic recommended.

(4) Have the syringe already prepared (as for hypodermic, paragraph 468).

(5) Hold the skin taut.

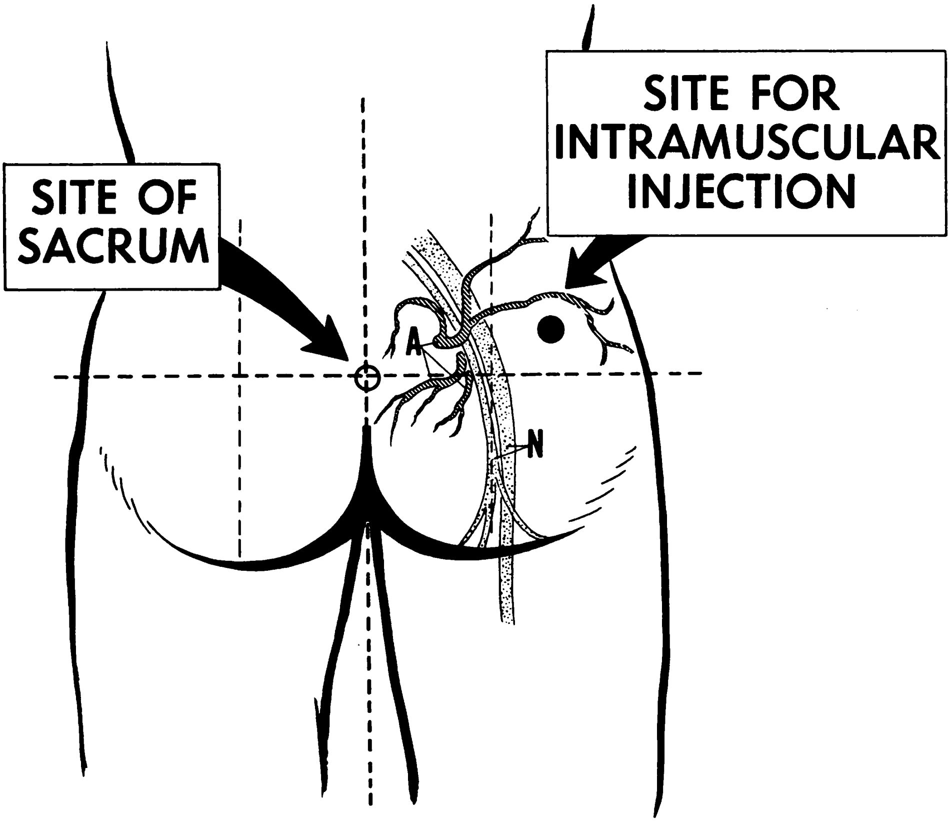


Figure 142. Site for intramuscular injection, showing location of sciatic nerve and blood vessels to avoid.

(6) Inject the needle with a stabbing motion to about half the desired depth and at right angles to the skin since it must penetrate the muscles.
(7) Make a second pressure—a light one, this time—and just enough to push the needle to the proper depth.
(8) Pull back the plunger slightly to check for blood. If blood appears in the syringe, remove the syringe, change the needle, and reinsert it in a new site.
(9) Slowly push down the plunger, injecting the contents.
(10) Remove the needle with a quick pull, cover the site with an alcohol sponge, and massage firmly for several minutes. (Do not massage an injection of pencillin since the repository effect is beneficial.)

470. Intravenous Administrations

Intravenous injection is the introduction of small amounts of solutions directly into the venous bloodstream. Intravenous injections are given only by the doctor. The specialist prepares the equipment and assists the doctor as needed.

a. Intravenous Injections.

(1) Intravenous injections usually require a large syringe and needle (size of syringe is determined by the amount of fluid to be given, and a 20- or 22-gauge needle is used). In hospitals these are sterilized by autoclaving and are drawn from a central supply room. A tourniquet and antiseptic solution for preparation of the skin are also needed (fig. 143).

(2) Using sterile precautions, the syringe and needle are assembled. The syringe is filled with the solution to be injected. The usual careful recheck is made to assure the proper drug and dose.

(3) A tourniquet is placed around the upper arm and drawn tight enough to block the veins but not the arteries. The skin over the antecubital space (front of the elbow) is painted with the antiseptic solution.

(4) The vein to be punctured and the point at which the needle is to enter are selected. If it is necessary to palpate the skin with the fingers to locate a vein, the skin is painted again. The vein is anchored by placing the left thumb on it about 2 inches below the point of injection.

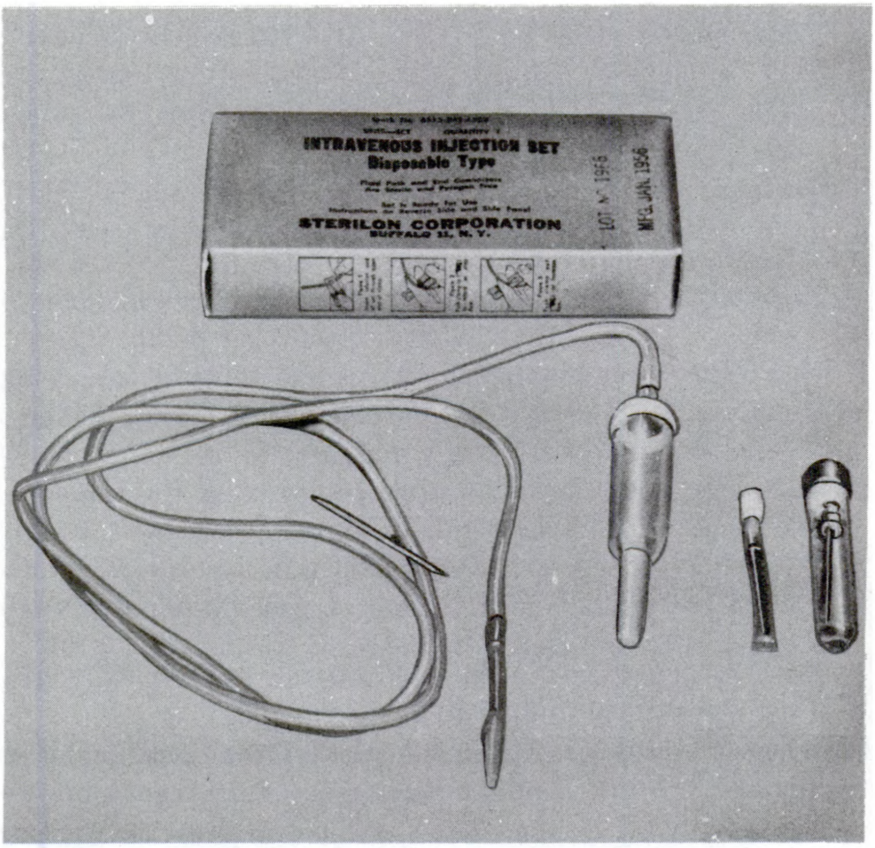


Figure 143. Intravenous infusion set.

(5) The syringe is held in the right hand. The needle, with its bevel up, is pointed in the direction of the flow of blood through the vein. The needle is inserted at a flat angle through the skin and immediately through the wall of the vein.

(6) When the wall of the vein has been punctured, the plunger of the syringe is withdrawn slightly to test if the needle is in the vein. The tourniquet is then released and the injection is given, fast or slow, according to the drug being used.

(7) The tissues at the point of injection should be watched and the plunger pulled back from time to time to see that the needle remains in the vein. If the tissues begin to swell, the injection is stopped at once, as this signifies that the needle has come out of the vein and the fluid is being injected under the skin. In this case the tourniquet will be replaced and the vein punctured in another site.

(8) When the injection is completed, the needle is withdrawn and a piece of sterile cotton or gauze is pressed firmly over the puncture site for several minutes to prevent blood from escaping into the tissues. The patient may be asked to do this.

b. Intravenous Infusion (venoclysis, "intravenous," "I. V."). This is the introduction of a large amount of fluid directly into a vein (fig. 144). The term is usually employed to describe the administration of fairly large amounts, as 1,000 cc. This procedure is normally done by the doctor, but may be done by the nurse or specialist in emergencies.

(1) The solutions most frequently used are the following:
  (*a*) Normal saline (0.85 percent solution of salt in sterile water).
  (*b*) Glucose solution (5 to 50 percent solutions in sterile water).
  (*c*) Normal saline and 5 percent glucose combined.
  (*d*) Whole blood.
  (*e*) Plasma expanders (dextran or others).

(2) The following equipment is required:
  (*a*) Intravenous tray and arm board.
  (*b*) Solution ordered.
  (*c*) Intravenous set.
  (*d*) Irrigating standard.
  (*e*) Needles, assorted sizes (18–22 gauge).

(3) Using aseptic technique, prepare the infusion set by removing the seals from the tubing and the Vacoliter flask. Insert the drip device into the flask; insert a 19-gauge needle into the air vent; attach the needle to the adaptor at the

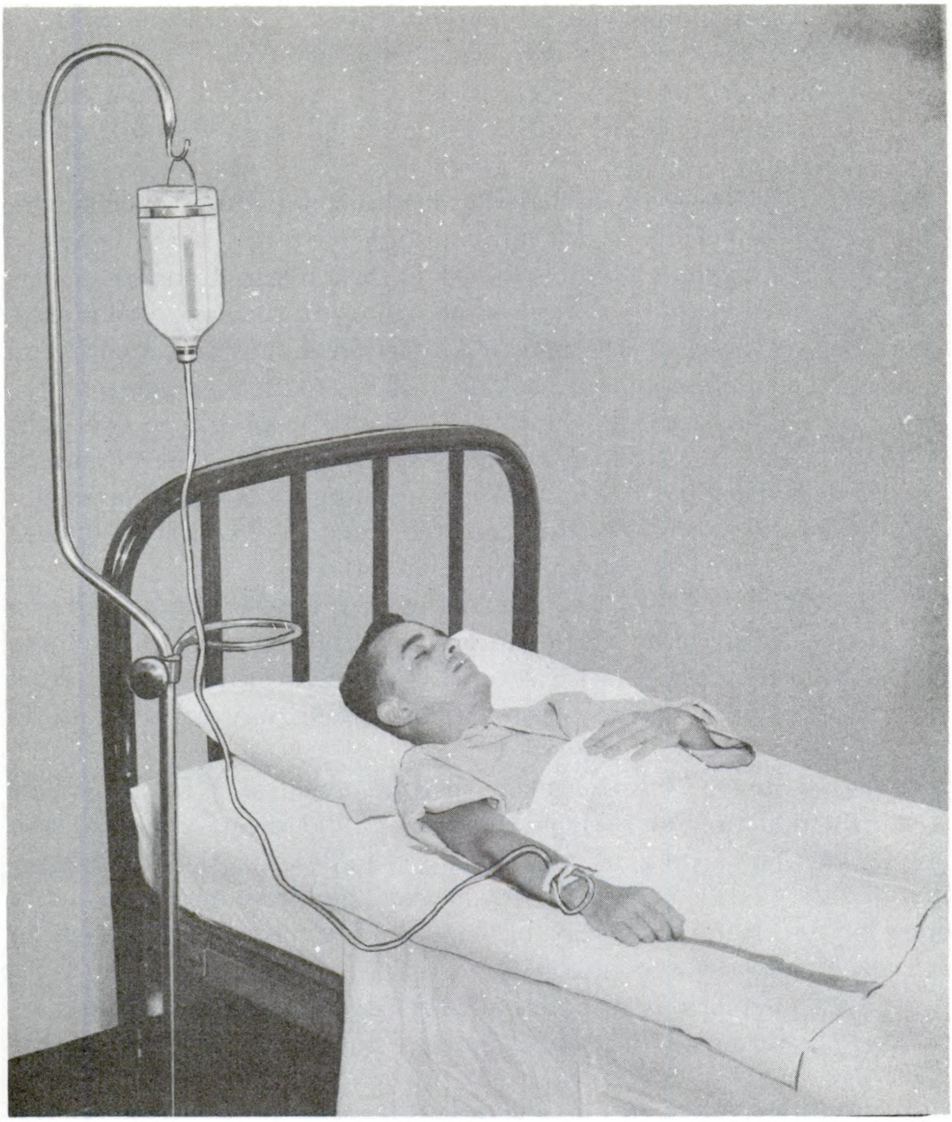


Figure 144. Intravenous infusion.

distal end of the apparatus. Place a clamp on the tubing. Carry the equipment to the bedside with the intravenous tray, arm board, and irrigating standard.

(4) Splint loosely the arm to be used to a padded arm board by applying a 3-inch roller bandage above and below the elbow. Take care not to put this bandage on so tightly that it acts as a tourniquet. Place a rubber tourniquet beneath the upper arm, but do not tie it. Prepare the antecubital surface with the disinfectant recommended by the installation.

(5) Hang the set beside the bed at the desired height (usually about 2 feet above the level of the elbow). Expel the air from the tubing and needle and clamp the rubber tubing.

(6) Tighten the tourniquet enough to block the veins but not the arteries and insert the needle (as described in *a* above). As soon as the needle enters the vein, the dark blood can be seen through the glass adaptor at the hub of the needle. Release the tourniquet on the upper arm and the clamp on the rubber tubing. Prop the needle in position by means of a small piece of gauze under its hub, and fasten it by a strip of adhesive tape over the hub and by another over the rubber tube, 6 or 8 inches from the needle. The rate of flow is 40 to 75 drops per minute. For a patient in shock, the liter of fluid may be given by a medical officer at a faster rate.

(7) After the doctor or nurse has performed the procedure outlined above, the specialist must observe the patient closely. Make and record frequent observations of the pulse, respiration, and color. Watch closely the solution in the flask so that it does not run out and permit air to enter the tubing. Observe and regulate the rate of flow as ordered by the ward officer. The clamp on the rubber tubing is the means of controlling the rate of flow. Watch the site of injection closely, and if the tissues begin to swell at the needle's point, clamp the tube and report to the doctor or the nurse at once. If the patient starts to have a chill, clamp the tube and call the nurse or ward officer. At the end of the infusion clamp off the flow and remove the needle. To prevent blood from leaking under the skin, keep pressure over the injection site with a sterile piece of gauze for several minutes.

c. Dextran Injection Set. Dextran is usually the preferred plasma expander. Injection sets of dextran are available as a standard item. The set consists of an infusion bottle, containing 500 cc. of 6 percent dextran, and the injection assembly. Dextran is given the same way as other intravenous infusions.

d. Whole Blood Transfusion. This transfusion is given in the same manner as any other intravenous infusion, the details varying with the type of apparatus used. The procedure is given in section V, this chapter, where both donor and recipient techniques are described. The great advantage of whole blood is that the blood cells are present. Careful typing and cross matching must be done before transfusion can be performed safely.

471. Intradermal Administration of Drugs (Intracutaneous)

In an intradermal injection a solution is introduced between the skin layers, in contrast to the hypodermic injection where the solution is placed beneath the skin.

a. General. This method of injection is used in skin testing to determine sensitivity to drugs, sera, and other allergens. It is also sometimes used to administer allergens for the purpose of producing

immunity (for example, for scarlet fever or the booster injection for typhoid immunity). Only the small amount specifically ordered is injected, using a very fine-gauge needle (25-gauge, ¼″ cannula) and a tuberculin syringe (fig. 145).

b. Procedure.

(1) Prepare the syringe and needle with sterile precautions as for any injection and withdraw the amount of solution ordered into the syringe.

(2) Prepare the skin of the palmar surface of the forearm with a colorless antiseptic solution, so that changes in skin color can be seen.

(3) Hold the skin taut with the thumb of the left hand and insert the needle *into*, but not through, the skin. The angle of the needle is very flat and the point must be inserted *only enough to cover the bevel.* Press the plunger slightly. The solution forms a small bleb in the skin into which you must advance the tip of the needle. The injection is then completed (fig. 146).

(4) Take care not to run the needle out of the skin on the other side of the bleb nor to go clear through and inject the solution under the skin.

472. Administration of Drugs by Inhalation

Gases or substances dissolved or suspended in gases may be breathed into the lungs. Drugs may be given in this way for their local effect on the tissues of the respiratory tract or for a general effect after absorption from the lungs.

a. Steam Inhalation. This is a method of treating inflammation in any part of the respiratory tract. The ward officer's order will state how often to give the inhalation and how long to continue each

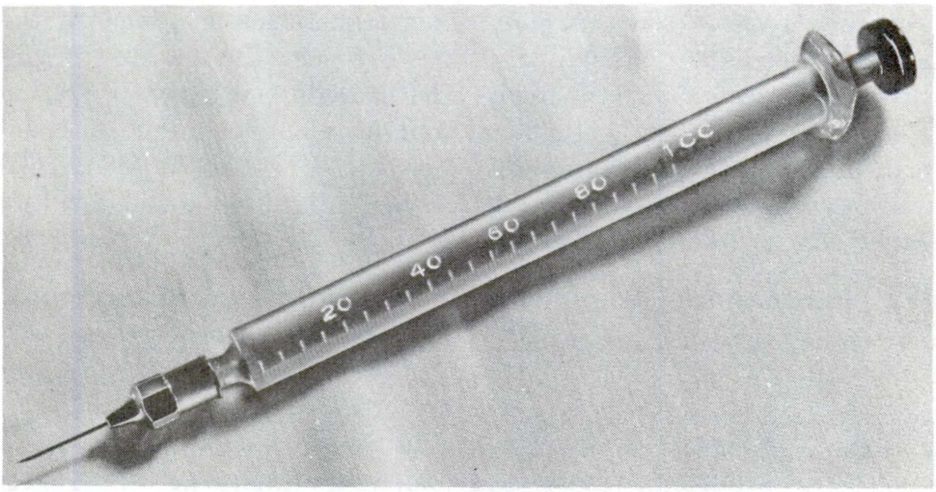


Figure 145. Tuberculin syringe.

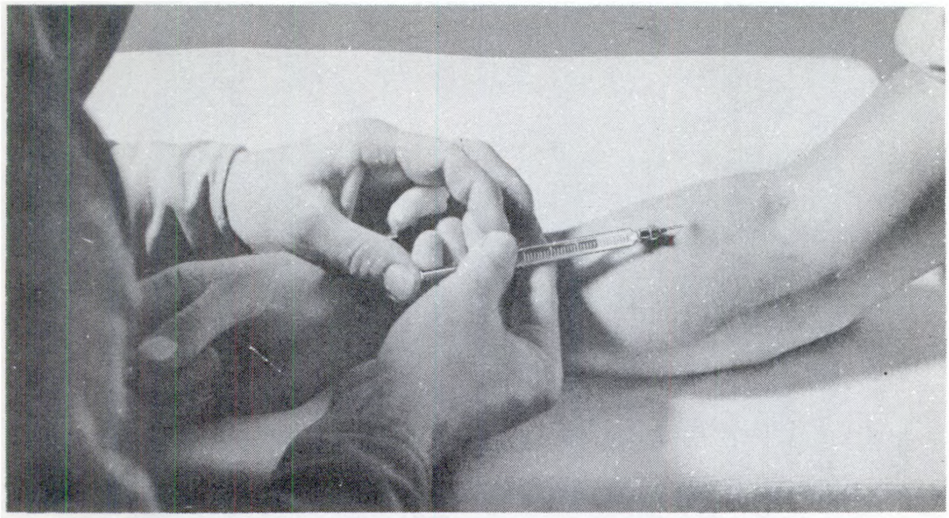


Figure 146. Intradermal injection.

treatment. It may also direct that some drug such as compound tincture of benzoin be added to the boiling water. About a liter of water is boiled in an open vessel, while the patient breathes the fumes. A sheet draped like a canopy over the patient's head may be used to prevent diffusion of the steam. There are several types of electric vaporizers, one or another of which is usually available in Army hospitals. In the vaporizer illustrated in figure 147, the prescribed solution is poured into the base of the machine. The solution is electrically heated and a motor drives the vapor up the tube. Be careful not to burn the patient with the steam. Direct the flow of steam *away from* the patient.

b. Nebulizer. Drugs dissolved in distilled water may be finely dispersed by means of a special sort of atomizer (fig. 148). This fine spray is inhaled from the tube (stem) of the nebulizer inserted in the mouth, and it is exhaled through the nose. Penicillin and some of the sulfonamides are used this way to treat infections of the lower respiratory tract. Adrenalin is sometimes given this way to treat asthma.

c. Oxygen Therapy. See paragraphs 474–481.

473. Rectal Administration of Drugs

Medications are often given in the form of a retention enema. They may be given for sedation, stimulation, or for local effect. If the patient has not had a bowel movement during the preceding 6 to 8 hours, it is best to precede the rention enema by an evacuation enema. Following this, wait 1 hour for the peristalsis to quiet down before injecting the retention enema. Inject the enema very slowly. Take 10 minutes to inject the 100 cc. of fluid to avoid causing distention and peristalsis. Use a small colon tube (20 Fr) instead of the

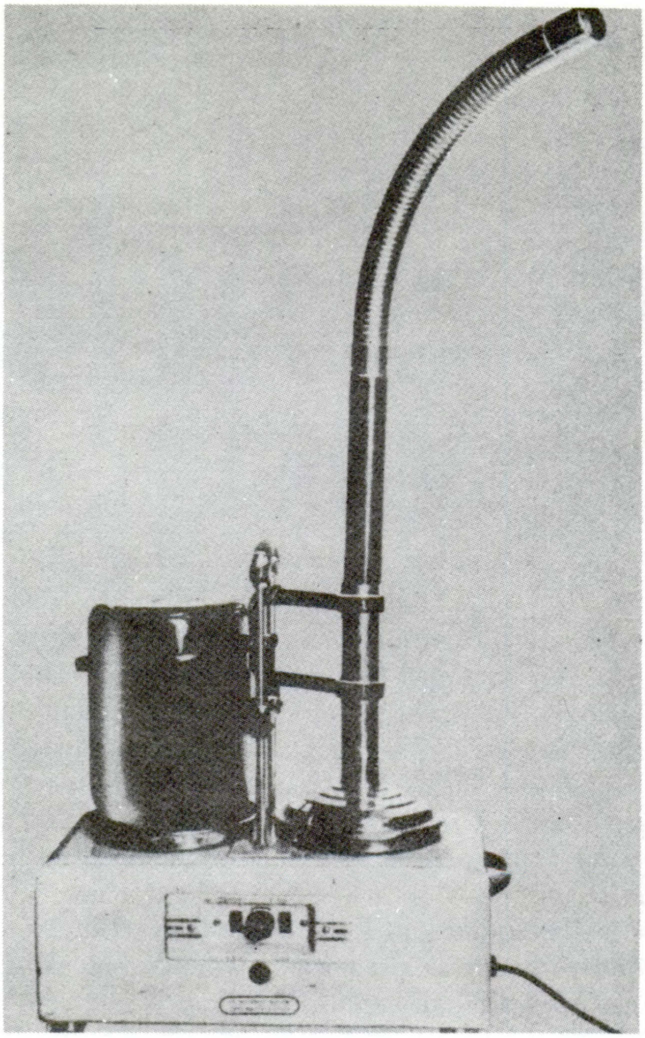


Figure 147. Electric vaporizer.

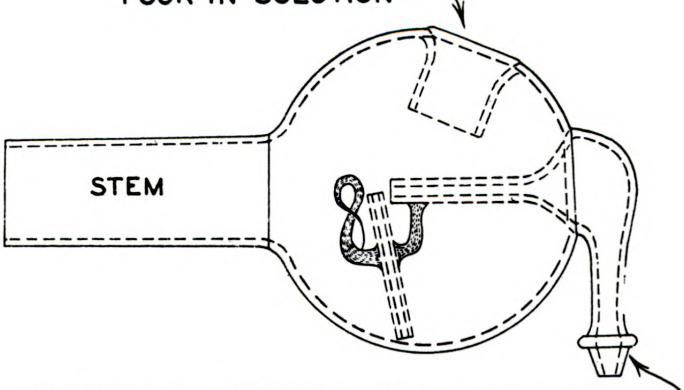


Figure 148. Diagram of a nebulizer.

large rectal tube; the large rectal tube, by stretching the anal sphincter muscle stimulates peristalsis. You may use a syringe to inject the drug. Urge the patient to hold the enema and not to expel it for at least an hour.

Section IV. ADMINISTRATION OF OXYGEN

474. General

When the body is unable to get enough oxygen to supply its needs, oxygen therapy is indicated. Oxygen deficiency occurs frequently in some types of heart and respiratory diseases, in shock, in severe hemorrhage, in poisoning, and following an anesthetic or drug. Oxygen therapy, therefore, is not a specific treatment for any particular disease but is used for oxygen deficiency, regardless of its cause. As the time element is often extremely important in getting the oxygen to the patient, you must be able to recognize signs of oxygen deficiency, must report it at once, and must know how to set up the equipment quickly and efficiently. Oxygen is piped to the bedside from a central unit in many hospitals; in others it is brought to the bedside in heavy metal cylinders. It is administered to the patient by means of nasal catheter, by mask, or by oxygen tent. No matter how oxygen is administered, certain precautions *must* be observed. In addition, there are certain fundamental principles of oxygen therapy which the specialist should know to ensure that the patient will receive the maximum benefit from the treatment.

475. Signs and Symptoms of Oxygen Deficiency

Hypoxia is the term used to designate oxygen deficiency. Listed below are the signs and symptoms of *hypoxia* in the order of their increasing severity. Complete lack of oxygen intake is described as *anoxia.*

a. Anxiety.
b. Yawning.
c. Headache.
d. Nauesa.
e. Increased pulse rate.
f. Cheyne-Stokes respirations.
g. Precordial pain.
h. Dizziness.
i. Cyanosis (bluish colorations of skin, especially lips and nails).
j. Dyspnea (difficult and labored breathing, air hunger).
k. Delirium.
l. Vomiting.
m. Muscle twitching or spasm.
n. Dilated pupil.

The signs and symptoms shown in italic type comprise the range that usually indicates the use of oxygen clinically. Those at the top of the list are mild. Those at the bottom of the list are signs of severe oxygen deficiency usually seen as a terminal condition when it may be too late to get any benefit from oxygen. Notify the doctor at once if you see *any sign* of oxygen deficiency. He will order oxygen therapy if he thinks it is desirable.

476. Precautions in Use of Oxygen

The presence of oxygen makes all material more combustible. Things that burn slowly in ordinary air will burn violently and even explosively in the presence of oxygen. In using any oxygen regulator avoid the use of oils and greases. These substances in the presence of high oxygen concentrations are likely to ignite and cause an explosion. Everyone who comes near the patient must be aware of the danger of fire and explosion. Warn the patient of the precautions that he and his vistors must observe to prevent fires. Check his bed and his side table for matches or lighters. Warning signs should be placed outside oxygen tents and outside the door if the patient is in a private room. If catheters or masks are being used, the signs should be placed where anyone who comes near the bed can see them. The patient should not be rubbed with alcohol nor oil. Electric devices of all kinds and any open flame must be banned. Use hot water bags instead of electric pads, a hand bell instead of a signal light. *DO NOT SMOKE.* Do not adjust the oxygen equipment with greasy hands. Fires are caused by carelessness or ignorance and should never occur. There is no reason to be afraid of using the oxygen apparatus if proper precautions are taken.

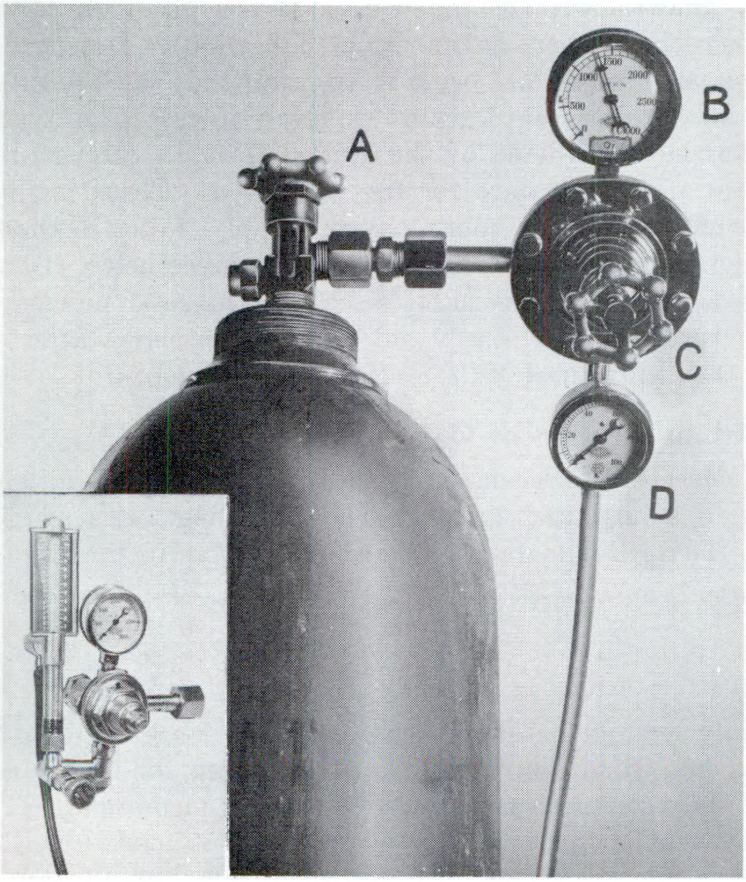
477. Preparation of the Patient for the Treatment

Adequate preparation of the patient for oxygen therapy is desirable. If he has the procedure explained to him ahead of time and knows what to expect, he will not be fearful, tense, or anxious.

478. Attaching the Regulator

Regardless of the source of supply and the method of administration, one of the first steps in setting up the oxygen equipment is attaching the regulator. If the oxygen is piped to the bedside, the regulator must be attached directly to the wall outlet. This regulator consists of a single gauge which indicates the flow of oxygen in liters. Be sure that the wing nut is tight. If oxygen is to be administered by nasal catheter or mask, attach to the regulator a jar of water through which the oxygen bubbles before going into the tube leading to the patient. This water humidifies the oxygen. It is not needed if you are going to use the oxygen tent, as the cabinet which is part of the tent equipment automatically cools and

humidifies the gas. Next, attach the oxygen tube, the glass connecting rod, and finally the nasal catheter or mask. Always turn on the oxygen gradually and make sure that its flow is even before administering the oxygen to the patient. If the oxygen cylinder is used, the regulator which is attached has two gauges: one shows the amount of oxygen in the cylinder; the other shows the rate of flow of the oxygen per minute (fig. 149). The regulator reduces the pressure of oxygen to a low pressure that is safe to use; it insures a steady, even flow of oxygen; and it provides a means for adjusting the rate of flow. Before you attach this regulator to the cylinder, remove the metal cap from the oxygen cylinder, and open and then quickly close the valve. This "cracking" of the cylinder blows dust and dirt out of the cylinder valve. Close the regulator screw, and then attach the regulator to the cylinder outlet, tightening the metal cuff with a wrench. Attach the jar of water (if it is needed) and



A. Cylinder valve
B. High pressure gauge
C. Flow adjusting screw
D. Low pressure gauge

Figure 149. Oxygen cylinder with attachments (insert shows another type of regulator).

then the tubing to deliver the oxygen to the patient. Watch the gauge and, one hour before the oxygen is exhausted, order another cylinder.

479. Oxygen by Nasal Catheter

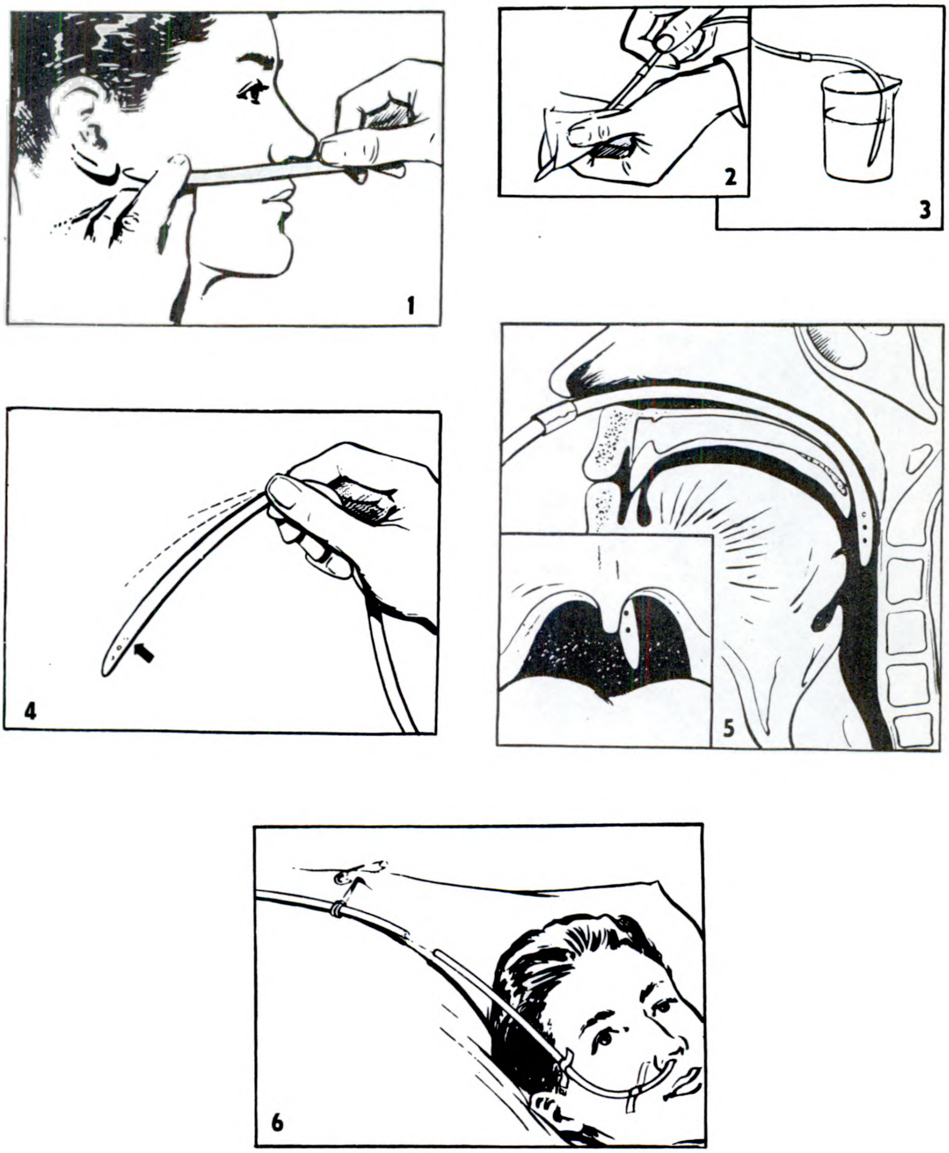
When the patient is to receive oxygen by nasal catheter, the soft rubber catheter, which has been lubricated, is inserted slowly into his nose. To get the approximate distance the tube will be inserted, measure the distance from the tip of the nose to the lobe of the ear, and mark this point with tape (1, fig. 150). Set the regulator at three liters per minute. Lubricate the catheter and hold it for a few seconds in a glass of water to be sure none of the terminal holes is plugged with the lubricant (2 and 3, fig. 150). With the oxygen flowing, elevate the tip of the nose and pass the end of the catheter (in the position of its greatest droop) (4, fig. 150) slowly along the floor of the nasal cavity until the patient swallows. This usually indicates that the catheter has reached the oropharynx. Then withdraw the catheter about half an inch (5, fig. 150). Tape the catheter to the patient's cheek and bring it up toward his ear, taping it again to the side of his face (6, fig. 150). Now increase the oxygen flow up to the amount ordered by the doctor. Pin the tubing to the pillow, allowing enough slack for free movement. Check the operation of the equipment every hour: oxygen supply, water in the humidifier, leaks in connections, and condition of the catheter. Change the catheter as frequently as nasal discharges make it necessary or at least every 12 hours. Wash and rinse all catheters after use and send to the Centralized Materiel Section for sterilization.

480. Administration of Oxygen by Face Mask

High concentrations can be obtained by using a mask fastened over the patient's nose and mouth. The following rates of flow will provide the approximate percentages of oxygen in the inspired air:

Flow in liters per minute	Percentage of oxygen
2	24–45
3–4	50–60
8–10	90–100

Ordinarily enough moisture remains in the mask to humidify the oxygen; but when concentrations of 70 percent or higher are used, patients may complain of dryness of mucous membranes. The oxygen can then be moistened by using a water bottle (as for nasal catheter in paragraph 483). Attach the regulator to the oxygen supply, and attach the tubing and mask to the regulator. Set the regulator to deliver the correct number of liters per minute as ordered. Adjust the mask to the patient's face and pass the strap around the back of his head just above or below the ears. Adjust the strap so that it is tight enough to hold the mask snugly but gently



1 Measuring catheter
2 Lubricating the tube
3 Testing patency of tube
4 Finding the droop of the catheter
5 Position of catheter
6 Taping catheter in place

Figure 150. Administering oxygen by nasal catheter.

against the face. Be sure that oxygen is not escaping at the top of the mask and blowing into the patient's eyes. When oxygen is administered under slight positive pressure, a mask which has a positive pressure attachment is used. This attachment contains an expiration flutter valve attached to the front piece of the mask (fig. 151). By adjusting the disk, oxygen can be administered under from 1 to 4 cm. of water pressure. If the mask is equipped with an oxygen concentration device, control the oxygen concentration by

Figure 151. Administration of oxygen by face mask.

adjusting the setting of the dial. The rate of flow is controlled by the flow-adjusting screw. If the mask is equipped with sponge rubber disks, oxygen concentrations are controlled by adjusting the rate of flow only. When less than 90 to 95 percent oxygen is administered, the rebreathing bag should collapse completely toward the end of each inspiration. For oxygen concentrations of 90 to 95 percent, adjust the liter flow at a sufficiently high rate so that the rebreathing bag never collapses even at the depth of inspiration. The required liter flow for these high concentrations will vary with the pulmonary ventilation of each patient. You should remove the face mask every 2 hours (unless contraindicated) and wash, dry, and powder the patient's face to lessen the irritating effects of the oxygen. When the treatment is discontinued, disconnect all parts and wash the mask and the rebreathing bag. Rinse them in an antiseptic

solution, rinse again thoroughly and allow them to dry. Store the equipment ready for use.

481. Administration of Oxygen by Oxygen Tent (fig. 152)

a. Equipment. The oxygen tent unit (air-conditioned type) consists of a cabinet that can be connected to a supply of oxygen and a canopy to cover the patient and part of his bed. The oxygen is air-conditioned in the cabinet and then forced into the tent by a motor-driven rotary blower or by pressure from the oxygen supply.

b. Setting up the Oxygen Tent. To set up the equipment proceed as follows:

(1) Attach the regulator.

(2) Connect the oxygen supply tube to the cabinet and to the regulator.

(3) Plug in the cord of the cabinet and snap on the switch to start the motor.

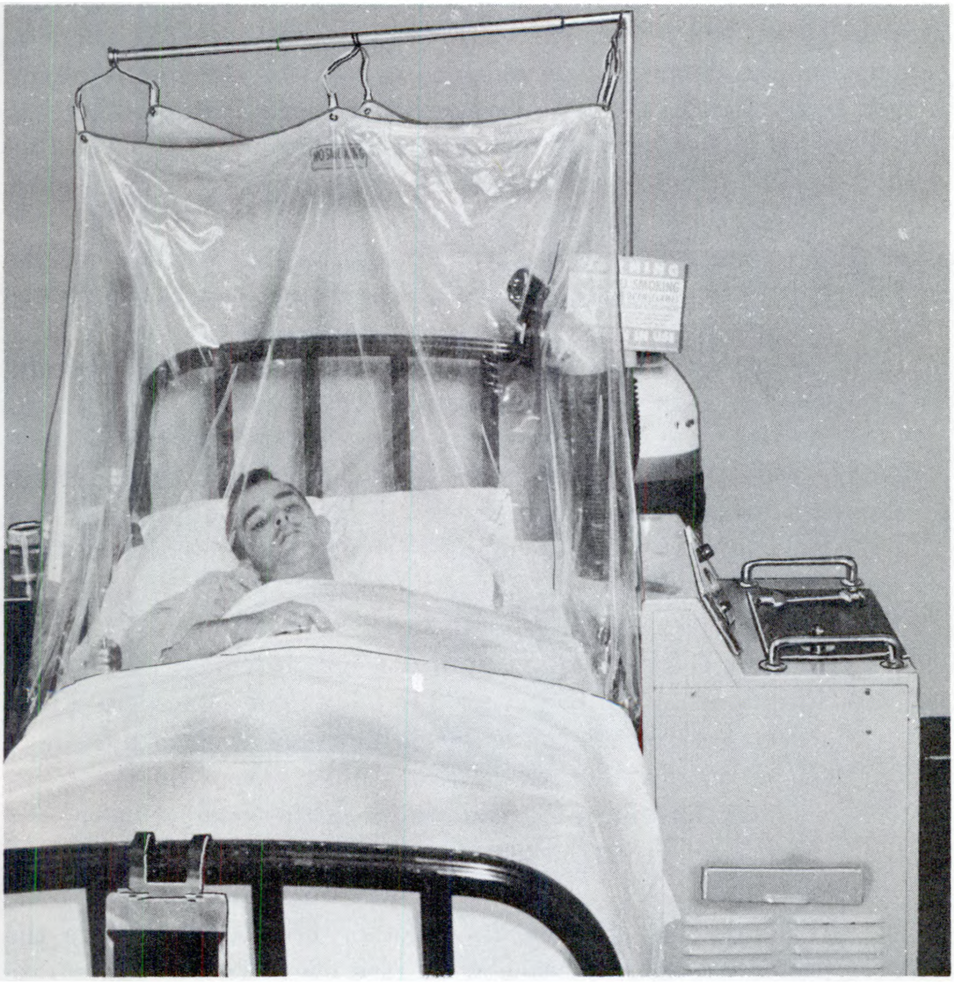


Figure 152. Administering oxygen by tent.

(4) Adjust the temperature control dial to the desired setting (usually 68° to 70° F.). Turn air circulation to "Fast" position. Start the oxygen (15 liters per minute).

(5) Place the tent canopy over the patient and adjust it. Tuck the canopy under the back and sides of the mattress and use a sheet to secure the part of the canopy that is over the patient's abdomen.

(6) Allow oxygen to flow at 15 liters per minute for 15 to 30 minutes; then analyze the atmosphere (*c* below) to make certain the patient is receiving the amount of oxygen ordered by the doctor.

(7) Adjust the rate of oxygen flow, then, to maintain the desired oxygen concentration (usually from 8 to 10 liters will maintain a concentration of 50 percent).

c. Determination of Oxygen Concentration. Oxygen concentration is determined by the oxygen analyzer. There are many types of oxygen analyzers, but they all depend upon the fact that the oxygen can be bubbled through a liquid which absorbs it. All analyzers are provided with detailed instructions for operation. Remove the rubber cap on the connection nipple on the side of the intake elbow. Attach the analyzer over the nipple. The oxygen concentration will then register on the dial of the apparatus. The process is a very simple one, but it is most important for adequate oxygen therapy.

d. Maintaining Oxygen Tent Therapy.

(1) To raise or lower the temperature in the tent, change the automatic temperature control, but do it only while the compressor unit is running.

(2) Open the canopy as infrequently as possible and then only as wide as is absolutely necessary.

(3) Analyze the oxygen content every three or four hours.

(4) Should the oxygen content be unaccountably low, inspect the canopy for leaks, check the oxygen supply tube for leaks, and check the content of the cylinder if this method of supply is used.

(5) If cylinders of oxygen are used, always order a new one an hour before the oxygen in it is exhausted.

(6) Empty the drain pan every 6 to 8 hours or as needed. (This receives the excess condensation from the cooling unit.)

(7) When oxygen therapy is discontinued, taper off the treatment by loosening the canopy to create leakage, or remove the patient from the tent for short intervals of about 15 or 20 minutes. If his pulse rate does not increase, such intervals may be lengthened. Another method is to give the patient oxygen by catheter or face mask with a slower rate of liter flow per minute.

e. Care of the Patient During Treatment. Problems arise in the nursing care of a patient who is receiving oxygen therapy. If a mask is being used, it must be removed when the patient eats or drinks. If a tent is being used, try to devise ways of giving nursing care so that there is no interruption in the administration of the oxygen and no waste of gas. Use the sleeve or zippered opening in the canopy to hand food or drink to the patient, to bathe his face, or to give mouth hygiene. In bathing him, slide the canopy up around his neck and tuck it under the pillow. In some hospitals the procedure is to remove the patient from the tent for his bath and to administer the oxygen during this period by mask or nasal catheter. Do not try to decrease the oxygen flow into the tent, as carbon dioxide would build up rapidly.

f. Care of the Equipment.

(1) Wash the canopy inside and out with soap and water and dry it thoroughly. Never use alcohol on the plastic windows. It clouds them.

(2) Wipe off the cabinet and all its fittings.

(3) Disconnect the regulator.

(4) Drain and dry the drain pan.

(5) If an oxygen cylinder is used, measure the oxygen remaining in the tank and mark the amount on the tag secured to the tank. Return the cylinder to the Centralized Materiel Section.

(6) Store the equipment ready for use or return it to the Centralized Material Section. Do not fold the canopy.

Section V. BLOOD TRANSFUSION

482. General

Blood transfusion is the transfer of whole blood from one individual (the donor) to another (the recipient). *Indirect transfusion,* is the usual procedure. The blood is drawn from the donor into a special bottle or plastic bag and treated with citrate to keep it from clotting. It may then be stored for several weeks at 4° C. In hospitals where many transfusions are given, blood is drawn in anticipation of this requirement and stored in refrigerators. When blood is needed for a transfusion, a sample of the recipient's blood is sent to the laboratory where it is typed. It is then directly crossmatched against a blood of corresponding type from the bank. If no agglutination occurs, the flask of blood is sent to the ward where it is administered to the patient. To replace this unit of blood, a donor is called; his blood is taken, citrated, and stored in the refrigerator.

483. Kinds of Transfusion

Two principal types of blood transfusion are *exchange transfusion* and *intravenous transfusion.* The *exchange transfusion* is performed to exchange with RH negative blood, the entire blood supply of an infant with *erythroblastosis fetalis.* *Intravenous infusion* is the type most commonly encountered in the hospital and is the one which will be explained below. It consists of transferring the blood from one person to the veins of another.

484. Blood Transfusion, Recipient Procedure

a. Equipment.

(1) Blood, as ordered.

(2) Blood transfusion set (disposable) (fig. 153).

(3) Other equipment as listed for intravenous administrations (par. 470), except that an 18 G. needle is used for this procedure rather than a 20 G.

b. Preparation of Recipient and Method of Procedure.

(1) Place infusion standard in position.

(2) Using a disposable transfusion set, prepare it as for an intravenous infusion (par. 470). Check the labels on the blood container with the transfusion form to assure the correct blood for the patient.

(3) The doctor starts the transfusion (fig. 154). He may wish to accomplish the venipuncture with a 2 cc. syringe and after blood appears in the syringe, remove the syringe from the needle and attach the tubing instead.

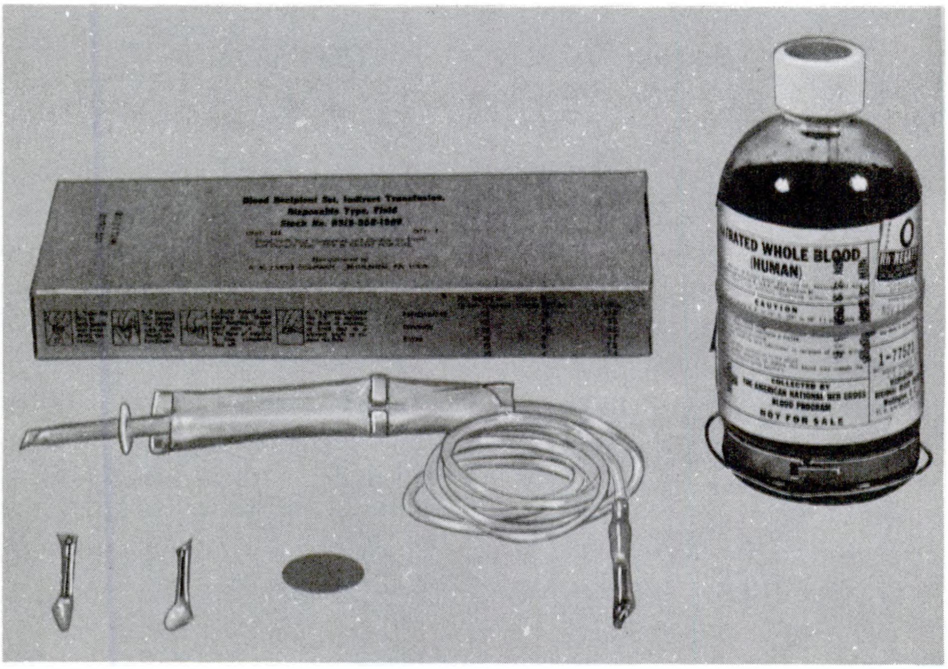


Figure 153. Vacuum flask type of transfusion set.

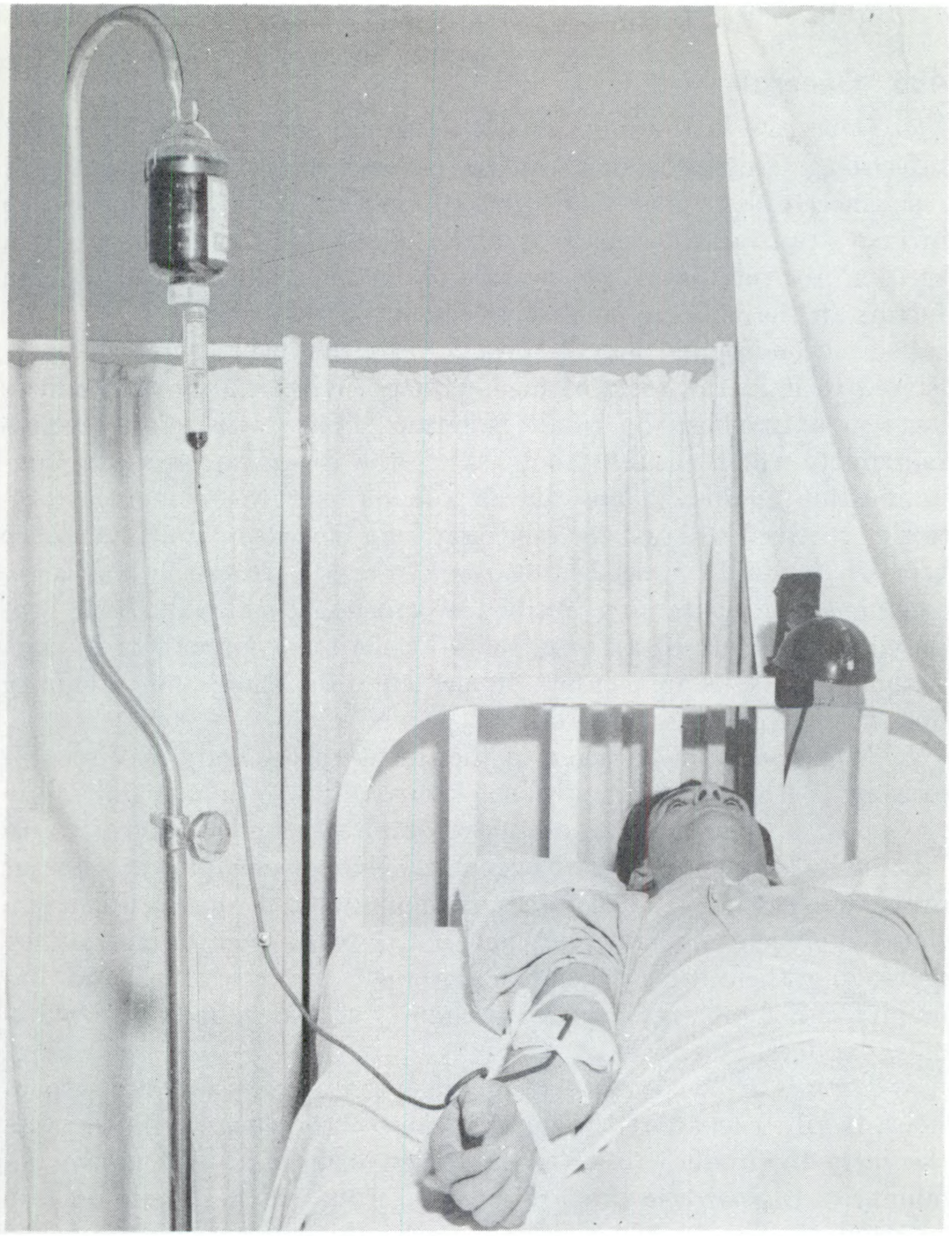


Figure 154. Patient receiving blood transfusion.

(4) Observe the patient carefully for signs of reaction (such as chills, increased pulse rate, restlessness). If signs of a reaction occur, clamp off the blood flow immediately and report to a nurse or doctor. If there is no reaction, continue the transfusion as directed by the ward officer. Keep the drip device about half filled with blood throughout the procedure.

(5) Following the transfusion take the patient's temperature every hour for 4 hours and record it on his chart.

(6) Chart the time and amount of the transfusion and any reaction.

Section VI. IMMUNIZATION

485. General

a. Immunity is the individual's resistance to a specific disease or infection. This resistance can be natural, as for example, man's resistance to distemper that attacks dogs; or it can be acquired, as in man's resistance to smallpox after he has had the disease or been successfully vaccinated. *Immunization* is the production of defense factors in the body to combat infection. These defense factors are called *antibodies* and may be produced by the body itself or administered to it in the form of medications. When the body produces its own antibodies, the result is termed *active immunity.* Active immunity, which results from having the disease or receiving immunization against it, may develop in days or weeks but the protection received will last for relatively long periods of time. Another type of immunity, described as *passive*, results from the body's receiving serum containing antibodies which have already been produced in the body of a horse, rabbit, some other animal, or human. Although this serum confers immediate protection, the immunity does not last as long as the other type.

b. Infection is the invasion of the tissues of the body by disease—causing (pathogenic) organisms. Their ability to invade and injure the body is due to their ability to multiply and produce *toxins* (poisons). If the number of organisms is great enough, their toxins overpower the body. The forces of immunity can combat this situation by preventing multiplication of the pathogenic organisms, by destroying them, or by neutralizing their toxins. If natural immunity is not present, acquired immunity should be induced by toxoids, vaccines, or antisera.

c. Toxoids are suspensions of modified toxins; *vaccines* are suspensions of killed or altered bacteria, rickettsia, or viruses. Both cause the body to produce its own antibodies, bringing about active immunity. *Antisera* are preparations of serum which already contain antibodies. They produce passive immunity and are used in emergencies when there is no time for the body of the infected person to produce its own antibodies. Antitoxins are antibodies against the toxins of disease organisms.

486. Responsibilities of the Medical Specialist

As a member of the Armed Forces you are obligated to inform yourself concerning the Army Immunization Program. Army Regulations 40–562 gives specific instructions regarding immunizations. Immunizations are good only if these regulations are adhered to. As a member of the medical team, you will assist others to understand and appreciate the necessity of these immunizations by explaining the program to other soldiers, and to their families and

dependents. If you work in a dispensary, you will be responsible for carrying out proper immunization techniques (especially for small-pox vaccination).

487. The Army Immunization Program

a. Routine. The Army requires all its military personnel to be actively immunized against smallpox, typhoid-paratyphoid, tetanus, diphtheria, poliomyelitis, and influenza. Table XII gives a summary of immunization schedules. The areas designated in the table by capital letters R, T, and so on are marked off in figure 155 as world areas for which certain immunizations are required. If a series is

Table XII. Military Immunizations (AR 40–562)

Agent	Overseas requirements	Basic series: Area	Basic series: Doses [1]	Basic series: Amount	Basic series: Interval	Re-immunizations: Doses [1]	Re-immunizations: Interval
Smallpox	1 year	R	1	1 tube	None	1	Every 3 years
		T, CT, Y, YCT					Every year
Typhoid-paratyphoid [2]	1 year	R	3 (H)	0.5cc	Not less than 7 days.	0.5cc (H) or 0.1cc (IC)	Every 4 years
		T, CT, Y, YCT					Every year
Tetanus-diphtheria [5]	4 years or 2 doses.	R, T, CT, Y, YCT	3 (IM)	0.5cc	2d: 1–2 mo after 1st. 3d: 1 yr after 1st.	0.5cc	Every 4 years and at time of injury.
Poliomyelitis [4] [6]	1 dose	R	3 (IM)	1.0cc	2d: not less than 4 wks after 1st. 3d: not less than 7 mo after 2d.	1.0cc	Voluntary
		T, CT, Y, YCT					At least 1 yr after 3d injection.
Typhus [3]	2 doses	T, CT, YCT	3 (H)	1st: 1.0cc 2d: 1.0cc 3d: 0.5cc	2d: not less than 7 days after 1st. 3d: not less than 6 mo after 2d.	0.5cc	Every year
Cholera	2 doses	CT, YCT	3 (H)	1st: 0.5cc 2d: 1.0cc 3d: 0.5cc	2d: not less than 7 days after 1st. 3d: not less than 6 mo after 2d.	0.5cc	Every 4–6 months.
Yellow fever [3]	16 days	Y	1 (H)	0.5cc of a 1:10 dilution.	None	0.5cc of a 1:10 dilution.	Every 6 years
	12 days	YCT					
Influenza [3]	Requirements may change from year to year.		1 (H)	Dosages change from year to year.	None	Dosages change from year to year.	As determined by OTSG, usually yearly.

[1] Under doses, (H) means "subcutaneous," (IM) means "intramuscular," (IC) means "intracutaneous."
[2] More than 2 reimmunizations are not required in Area R.
[3] Check for egg sensitivity.
[4] Required in military personnel under 40 years of age; voluntary otherwise.
[5] Emergency stimulating doses may be administered with either tetanus toxoid plain or tetanus-diphtheria toxoids (Adult use).
[6] Check sensitivity to penicillin or streptomycin.

interrupted before completion, it should not be started again, but completed by giving the remaining injections, disregarding the lapse of time. If a period of time longer than that prescribed between stimulating (booster) doses has elapsed, the initial series is not repeated. The prescribed stimulating dose is adequate once the initial series has been given.

b. Other Immunizations. When personnel travel into areas where other diseases are prevalent, or during epidemics, other immunizations may be required; such as for yellow fever, typhus, and cholera. Re-immunization against diphtheria is required in some instances. See AR 40–562 for details on immunization requirements. A complete basic series will not be repeated for cholera or typhus.

c. Immunization Record (SF 601). This form is prepared (in original only) for all personnel when the initial series of immunizations is given. It is kept in the Health Record. All immunizations will be recorded on this form. It is not only the official record of an individual's immunizations and related data, but also the source of information for completing the Immunization Certificate.

d. Immunization Certificate (DD Form 737). During the initial series of immunizations, required data are entered on this form and on the Immunization Record. When initial immunizations have been completed, the Immunization Certificate is furnished to the individual concerned. It remains with him and is used to record all other immunizations he receives. If an individual loses his Immunization Certificate, another is prepared with data from the Immunization Record filed in his Health Record. Signature regulations for the Immunization Certificate must be in accord with AR 40–562.

488. Storage of Vaccines

Smallpox and yellow fever vaccines must be stored at temperatures below 32° F. Even colder temperatures are preferable. This means both vaccines should be kept in the freezing compartment of a refrigerator. Other immunizing agents should be stored in a refrigerator at temperatures between 35° and 50° F. With these immunizing agents, lower temperatures should be avoided because freezing may result in damage. On the other hand, these immunizing agents are relatively stable and do not lose their potency if kept at ordinary outdoor or room temperatures (33° to 93° F.) for periods up to one week. *Do not use vaccines or other immunizing agents after the date indicated on the bottle.*

489. Immunization Methods

Four principal methods are used for immunization: subcutaneous, intramuscular, intradermal, and multiple pressure technique. Vaccine for typhoid, paratyphoid, typhus, yellow fever, and cholera are given by the subcutaneous method (par. 468). For diphtheria toxoid

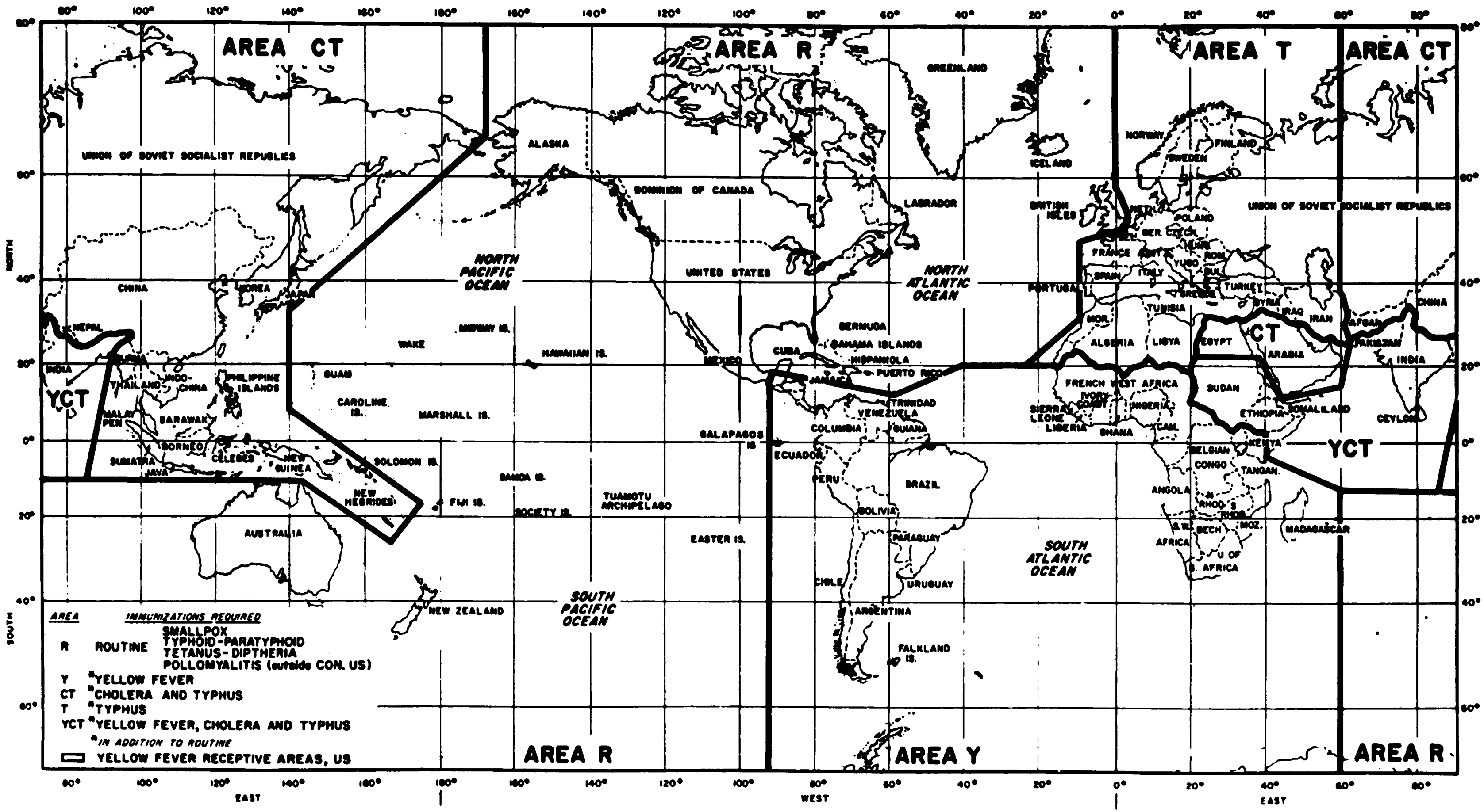


Figure 155. Immunization requirements for various world areas.

and poliomyelitis (Salk) vaccine, intramuscular injections are used (par. 469). Certain immunizations are given by intradermal injection when small doses are given. This is a method commonly used for sensitivity tests, given before administering antitoxins. The multiple pressure method, in which vaccine is introduced into the skin is used for smallpox vaccination.

490. General Rules and Safety Precautions

a. Follow the standing operating procedure of the installation and AR 40–562.

(1) A physician should be physically present or at a specific place known to the vaccinator whenever injections are being given.

(2) Have the following ready for immediate use: Epinephrine (adrenalin) 1:1,000, sterile syringe, needle, and tourniquet.

(3) Always check with the patient and his Immunization Certificate for any history of allergy sensitivity. Allergy to eggs, meat, fowl, and penicillin, and past allergic reactions to vaccines or sera are of special importance. Refer all allergic patients to the Medical Officer.

b. Maintain good aseptic technique. During mass immunizations there may be changes in procedure, but principles will remain the same. Use a separate needle and syringe for each injection.

c. Follow directions on the label. These include storage directions and expiration date. Do not use the contents after the date indicated on the bottle.

d. Record properly all immunizations on Immunization Certificate (DD Form 737). This includes a clearly legible date and the initials of the person administering the immunization; except that in the case of smallpox, yellow fever, or cholera the full signature of the medical officer or other person administering the vaccine is required. Record also any unusual reactions to immunizations. Description of symptoms of various unfavorable reactions to immunizations may be found in TB Med 114.

491. The Intradermal Skin Test

a. General. Any patient who has a history of sensitivity to eggs or to animal serums should first be tested by a small preliminary intracutaneous injection of the serum or vaccine to be used. If a wheal appears after a specified time at the injection site, he is allergic to the serum or vaccine. Disposition of patients with allergic reactions will be determined by the attending physician. Patients who have received the same serum previously are especially liable to be hypersensitive. This test is always performed by a physician or under his supervision.

b. Procedure.

(1) Assemble equipment:

(*a*) Alcohol 70% and cotton balls for cleaning skin.

(*b*) 2 tuberculin syringes.

(*c*) 2 needles (26–27 gauge).

(*d*) Serum or vaccine.

(*e*) Epinephrine.

(2) Follow procedure as described in paragraph 514.

(3) After the needle is removed, do not clean or massage the area.

(4) A control injection may be made on the other arm and a careful record kept to avoid possible errors in reading the tissue reaction.

492. Smallpox Vaccination

a. Smallpox Vaccine. This vaccine contains vaccinia virus, which is a slightly modified cowpox virus. Each dose is sealed separately in a glass capillary tube.

b. Essentials of a Successful Smallpox Vaccination. Successful vaccination requires potent vaccine. Potency of this vaccine can be lost if the vaccine is not stored properly (par. 488). Furthermore, the proper procedure must be used in preparation of the vaccination site, care of the site after vaccination, reading and recording the reaction to the vaccination, and revaccination of patients with negative reactions. Dried smallpox vaccine, when available, has different packaging and storage requirements. Read and follow the package directions carefully when using this material.

c. Procedure.

(1) Wash hands.

(2) Assemble equipment:

(*a*) Smallpox vaccination set.

(*b*) Four-ounce bottle of acetone or a four-ounce can of ether.

(*c*) Jar of cotton balls.

(*d*) Waste container.

(3) Prepare the equipment.

(*a*) Check label carefully (note expiration date).

(*b*) Remove needle container from vaccination set and place to one side.

(*c*) Remove one capillary tube of vaccine from the smallpox vaccination set.

(*d*) Break the capillary tube at one end where there is no vaccine and discard the broken tip in the waste container.

(*e*) Attach the rubber bulb to the broken end of the capillary tube and place on the table.

(4) Cleanse the site for vaccination with a cotton pledget and acetone or ether and permit it to dry thoroughly in the air but do not wipe it dry.

(5) Administer the vaccine.

(*a*) Pick up the glass capillary tube and carefully break off the other end where there is no vaccine.

(*b*) Place your finger over the hole in the rubber bulb and express the entire contents of the vial on the area where the skin has been cleansed.

(*c*) Save the rubber bulb, but discard the empty vial into the waste container.

(*d*) With your right hand remove the needle from the container, grasping the needle at the blunt end. If the needle is sealed in a capillary tube, break the vial at the end containing the blunt end of the needle, and then remove the needle.

(*e*) With your left hand grasp the underside of the patient's arm to support it, and hold the skin taut.

(*f*) Holding the sterile end of the needle parallel to the skin surface, press the needle through the drop of vaccine. Use pressure firm enough to break the skin but not enough to draw blood (fig. 156). Confine the area of vaccination to the smallest area possible. Apply this pressure 30 times.

(*g*) Discard the needle in the waste container.

(6) Instruct the patient to allow the vaccine to dry before he puts on his jacket. Ask him to refrain from scratching the vaccination site and to return for a reading in two days and again in eight days.

(7) Wash your hands thoroughly.

(8) Record the vaccination properly on the Immunization Certificate.

d. Interpretation of Results. An inspection of the results of the vaccination is made after 3 to 4 days and again after 7 to 10 days. All reactions start with a small swelling and redness of the skin.

(1) *Immediate reaction* occurs in immune persons or may simply be an allergic reaction in people who may or may not be immune. A positive reaction appears within 24 hours, is very mild, passes its peak in 2 to 3 days, but is still evident at 7 to 10 days. Reactions which disappear earlier must be interpreted as "*no reaction.*"

(2) *Accelerated reaction* occurs in partially immune persons. The swelling appears in about 36 hours and reaches its peak in about 4 to 8 days with a small blister and area of redness. It subsides rapidly.

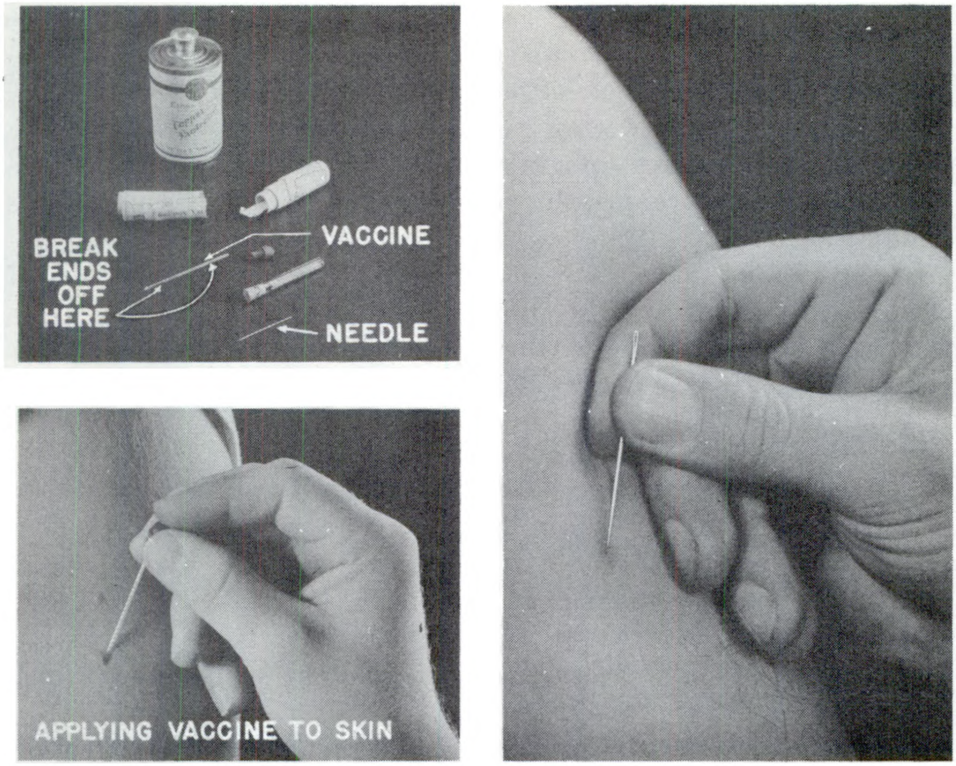


Figure 156. Vaccination for smallpox.

(3) *Primary reaction* occurs where there is no immunity to smallpox. The swelling appears about the third day. A blister forms on top of the swollen area, becomes larger and more inflamed, and reaches its peak in about 10 days. The blister fills with a fluid-like pus. Then a crust forms on the area. This usually falls off by the 21st day.

(4) *No reaction* means that the vaccine was inert or that an improper technique was used. In such a case the vaccination must be repeated. If there is any question whether the response was no reaction or immediate reaction, revaccination should be accomplished.

493. Salk Poliomyelitis Vaccine

a. General. The Salk poliomyelitis vaccine, an effective method for prevention of paralytic poliomyelitis, is given to all military personnel under the age of 40. Personnel over age 40 and other persons for whom the Army normally provides medical care may be vaccinated on a voluntary basis. People who work where the risk of exposure to paralytic poliomyelitis is high should be particularly encouraged to receive immunization. This includes laboratory workers, personnel of dispensaries, pediatric and outpatient clinics, and the clerical, nursing, and food service personnel employed in communicable disease wards.

b. Dosage and Administration. Immunization with this vaccine consists of three intramuscular injections of 1 cc. each, with an interval of 4 to 6 weeks or longer between the first and second injection. The interval between the second and third injection should be at least 7 months. An interval of 2 or 3 months in excess of the intervals stated above does not require the initiation of a new series of injections.

c. Precaution. Since polio vaccine is prepared in the presence of antibiotics (penicillin and streptomycin or streptomycin alone), those who have had past severe reactions to these antibiotics should not receive the vaccine containing the incriminated antibiotic.

494. Influenza Vaccine

a. Requirements. Requirements for influenza vaccine may change from year to year. Currently, the vaccine is given during October to all Army personnel on active duty. In addition, it is given to personnel who enter upon active duty in the Army before 1 August. In oversea areas, vaccination on a voluntary basis may be offered to dependents of military personnel and to other persons for whom the Army normally provides medical care.

b. Dosage and Administration. For Army personnel and other persons 13 years of age and older, immunization consists of one subcutaneous injection of 1.0 cc. of influenza vaccine. Children aged 6 through 12 years are given two subcutaneous doses of 0.5 cc. each at an interval of 1 week. Vaccination of children under 6 years of age is not recommended as a routine procedure. However, when vaccination is indicated, children aged 3 months through 5 years may be given two intradermal injections of 0.1 cc. at an interval of 1 week.

c. Precautions. The influenza vaccine is made of a virus which has been grown on chicken embryo eggs. Therefore, the vaccine should *not* be given to any person who is sensitive to egg or chicken protein.

CHAPTER 11

SPECIAL PATIENT CARE AND RELATED PROCEDURES

Section I. MEDICAL ASEPSIS

495. General

In the nursing care of patients with communicable or infectious diseases, the specialist must know and practice the principles of medical asepsis. Medical asepsis strives to confine the disease-producing organisms within a given area—usually the infected patient and his immediate surroundings. The practice of medical asepsis helps to prevent the spread of disease from the patient to other persons.

496. Isolation Technique

Isolation technique is a method of carrying out medical asepsis. It consists of isolation of the patient, handwashing and use of protective clothing by personnel who care for or visit the patient, and disinfection of materials and utensils coming in contact with the patient.

497. Isolation of the Patient

a. Location of Isolation Unit. If no special ward or private room has been designated, a private cubicle or a unit screened off from others in the ward can be set up as an isolation unit. In selecting an area on an open ward for an isolation unit, the place of choice would be at the farthest end of the ward.

b. Designation of Clean and Contaminated Areas. Areas in a ward or cubicle are designated as "clean" or as "contaminated" and are sometimes so marked by red, white, and blue zones. Areas usually considered contaminated include all floors, the interior of the patient's unit and bath area, certain areas of the utility room (sink, hopper, inside the linen hamper), and certain areas of the ward kitchen (the sink, designated counters and carts, and garbage containers). Clean areas are the offices, the linen room, the supply room, certain areas of the utility room, and certain areas of the kitchen. Everyone must be aware of these clean areas and be careful not to contaminate them.

c. Setting Up an Isolation Unit.

(1) Assemble all equipment needed from the utility room, supply room, and linen closet at the same time. Avoid making extra trips.

(2) Place in or on the bedside table the following equipment:

(*a*) Bath basin.

(*b*) Emesis basin.

(*c*) Urinal.

(*d*) Powder for backrub.

(*e*) Individual thermometer in container with solution.

(*f*) Box of tissue wipes.

(*g*) Paper bag for disposal of soiled tissues.

(*h*) Signal bell.

(3) Screen off entire bed unit.

(4) Attach "Isolation" sign to screens.

(5) Place linen hamper just outside opening to screens (or it may be kept within the area according to SOP).

(6) Attach sign "Contaminated Linen" to linen hamper.

(7) Set up handwashing facilities if running water is not available. To do this, place on a small table the following equipment:

(*a*) 1 basin of soap or detergent solution.

(*b*) 1 basin of clear water.

(*c*) Paper towels.

(8) Place covered "step-on" can (or a wastebasket lined with newspaper) beside the table for disposal of soiled paper towels.

(9) Place a paper bag or a container of masks on a table near the hand care unit. Attach a paper bag labeled "soiled masks" to one side of the table.

(10) Place gown on an IV stand or a hook just outside the patient's unit. (Some installations hang the gown inside the patient's unit; others use "discard technique." Gown technique is described in paragraph 500.)

498. Hand Care

The greatest single factor in preventing the spread of disease is washing the hands before and after caring for a patient. Scrubbing the hands with soap, water, and a brush is effective, but this irritates the skin if repeated frequently. In most hospitals, a disinfecting solution is used. This disinfectant reduces the number of microorganisms on the hands, requires less time for scrubbing, and has a residual effect. The supply of cleansing agent and disinfectant and the water for hand washing are usually controlled by levers operated by the foot, the knees, or the elbows. Washing the hands in running water is the preferred method, but if running water is not available,

basins of soap and water are placed at the entrance to the isolation ward. These basins must be emptied and refilled frequently. The procedure recommended by the hospital should be strictly followed. The important principle to remember is to wash your hands thoroughly and frequently. The following procedure is a typical one:

a. Use warm running water with soap or disinfectant solution.

b. Wash hands for a minimum of one minute.

c. Rinse them under cold water with hands held down to allow the water to drain off the finger tips.

d. Dry with a paper towel.

e. Use hand lotion frequently to keep skin in good condition.

499. Mask Technique

Masks are frequently worn on a communicable disease ward to protect the worker from inhaling air containing droplet infection. If they are worn, put on the mask while your hands are clean and before you enter the patient unit. The following procedure is a typical one:

a. Wash hands.

b. With forceps remove clean mask from container.

c. Open mask by pulling strings.

d. Place the mask over your nose and mouth.

e. Tie it in a bow knot at the back of your head and neck.

f. When you have finished wearing it, wash your hands, untie the strings. Drop it by the strings into the container for soiled masks.

g. Always change your mask at least every hour and more often if it becomes damp.

h. If for any reason you have taken off your mask or it has slipped, get a new mask.

500. Gown Technique

a. General. In some cases gowns are used by ward personnel to protect their clothing. Visitors also may be required to wear gowns. If gowns are used, the simplest procedure is to have enough gowns so that the worker may put on a clean gown each time he enters the ward and discard it as he leaves the ward. This "discard technique" is used in most hospitals.

b. The Discard Technique.

(1) *Donning the gown and mask.*

(*a*) Wash your hands.

(*b*) Put on your mask (par. 499).

(*c*) Take gown from cabinet.

(*d*) Thrust your hands through the sleeves and draw the neck of the garment into place.

(*e*) Tie the gown at the neckband in the back.

(*f*) Grasp both edges of the back of the gown, roll them together and draw the belt into place.

(*g*) Fasten the belt ends while you hold the rolled edges in position.

(2) *Removing the gown and mask.*

(*a*) Untie the belt and push sleeves up about two inches.

(*b*) Wash your hands without touching the cuffs of the gown.

(*c*) Place fingers under the cuff and pull down the sleeve over the hand without touching the outside of the gown.

(*d*) With hand inside sleeve, draw other sleeve down over hand.

(*e*) Slip out of gown by working hands up to shoulder seams of gown.

(*f*) Keeping hands inside under the shoulder seams, lift gown off shoulders. Roll gown away from you, with the contaminated side *inside.*

(*g*) Place it in a container for contaminated gowns.

(*h*) Remove mask, as described in paragraph 542, and place in contaminated container.

(*i*) Wash hands.

c. Technique When Gown is Used More Than Once (*Gown Hanging Outside the Patient Unit*).

(1) *Putting on the gown.*

(*a*) Remove gown from hook by lifting up under the shoulder seams that rest on the IV stand.

(*b*) Grasp back corner or neck near tie strings.

(*c*) Open gown. Keep tie strings on inside of gown.

(*d*) Slide hands into sleeve openings and work arms into sleeves by raising arms upward and outward. If necessary, cross arms and push sleeves against each other to work cuff over hand. DO NOT CONTAMINATE HANDS (1, fig. 157).

(*e*) Locate neck strings. Avoid touching hair or face with sleeves of gown.

(*f*) Tie neck strings. Keep chin from resting on front of gown.

(*g*) With both hands (which are still clean) reach to center of back and work toward sides until edges of gown are located.

(*h*) Bring clean edges together and roll tightly until gown fits snugly (2, fig. 157).

(*i*) Hold roll in place with one hand and bring belt ties from front to back and tie in a bow.

(2) *Removing the gown.*

(*a*) Untie neck strings at the back of the gown.

(*b*) Wash hands.

(*c*) Place fingers and thumb under one cuff, pinch it, and pull over one hand (3, fig. 157).

(*d*) Pull cuff across hand to make a mitt.

(*e*) Using the mitt, grasp the cuff of the opposite sleeve and pull sleeve down over the hand. Do not touch the skin with the cuff of the gown (4, fig. 157).

(*f*) Work hands out of sleeves to shoulder seams. Do not touch the outside of the gown.

(*g*) Hold gown away from body and bring hands together in front. (Both shoulder seams are now together.)

(*h*) Carefully turn one shoulder inside-out over the other shoulder.

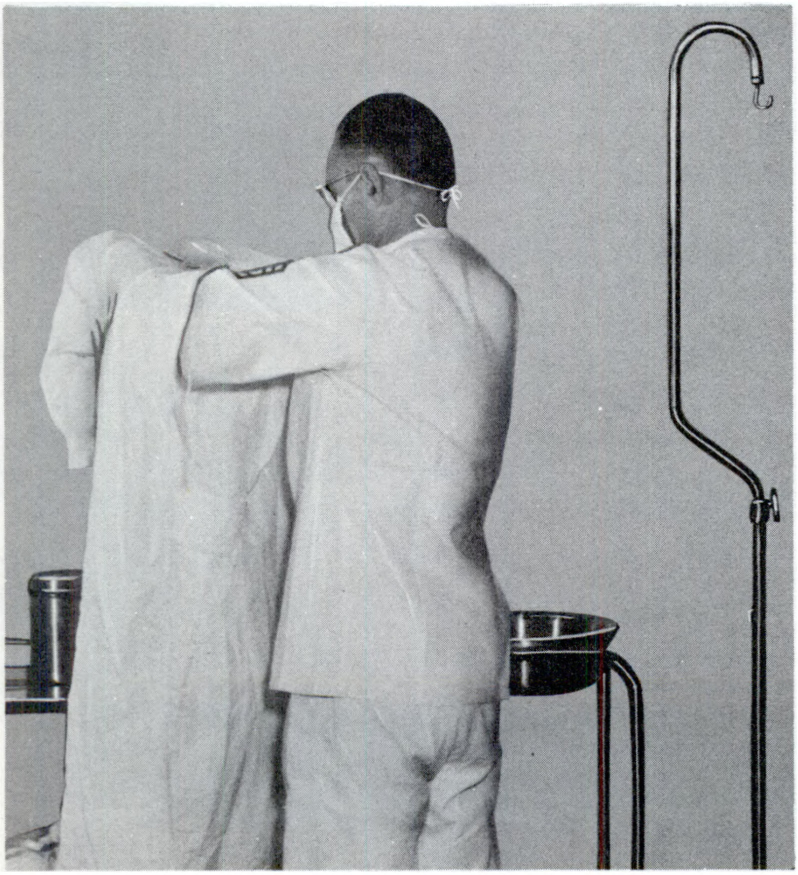
(*i*) Hang the gown on the hook, supported by the shoulder seams (5, fig. 157).

(*j*) Check to see that the edges of the gown are together.

d. Technique When Gown Is Used More Than Once (*Gown, Hanging Inside Patient's Unit*).

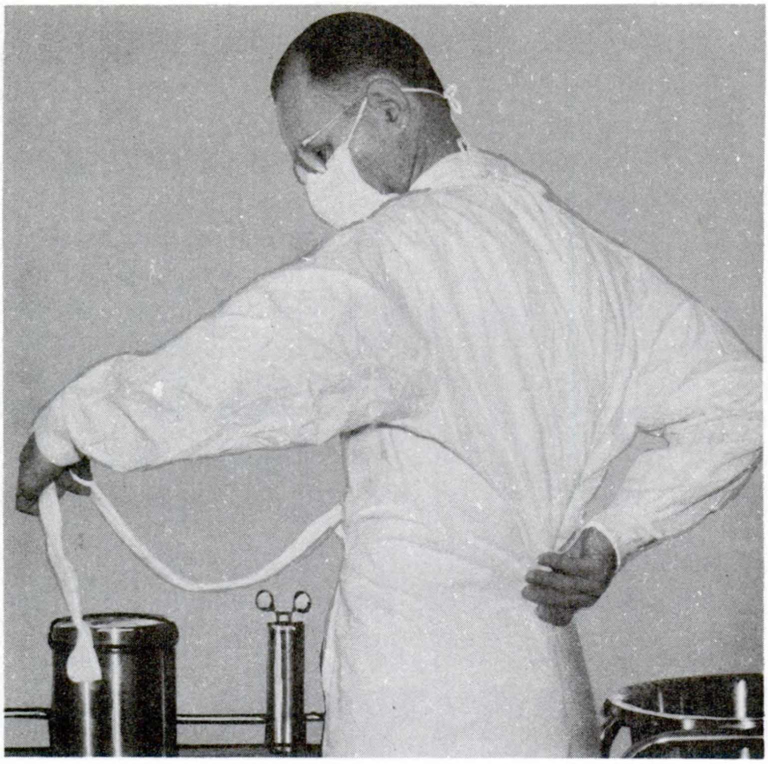
(1) *Removing the gown from the standard.*

(*a*) Slip hands inside back opening to shoulder, holding gown inside shoulder seams and remove from hook (1, fig. 158).

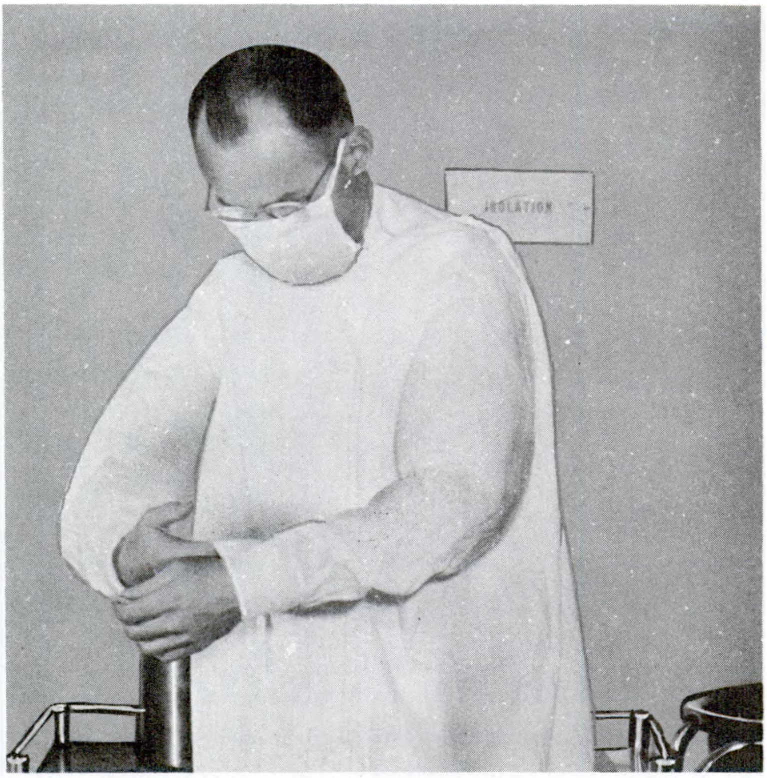


1 Sliding hands into sleeve openings

Figure 157. *Gown technique (re-use technique when gown is hanging* ***outside*** *the patient's unit).*

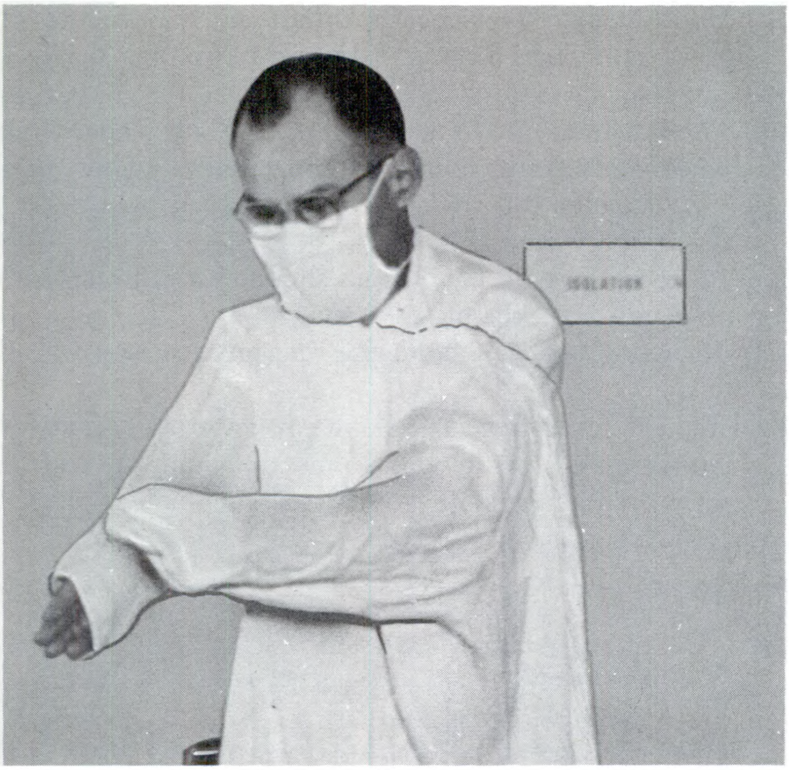


2 Rolling edges of gown together in the back

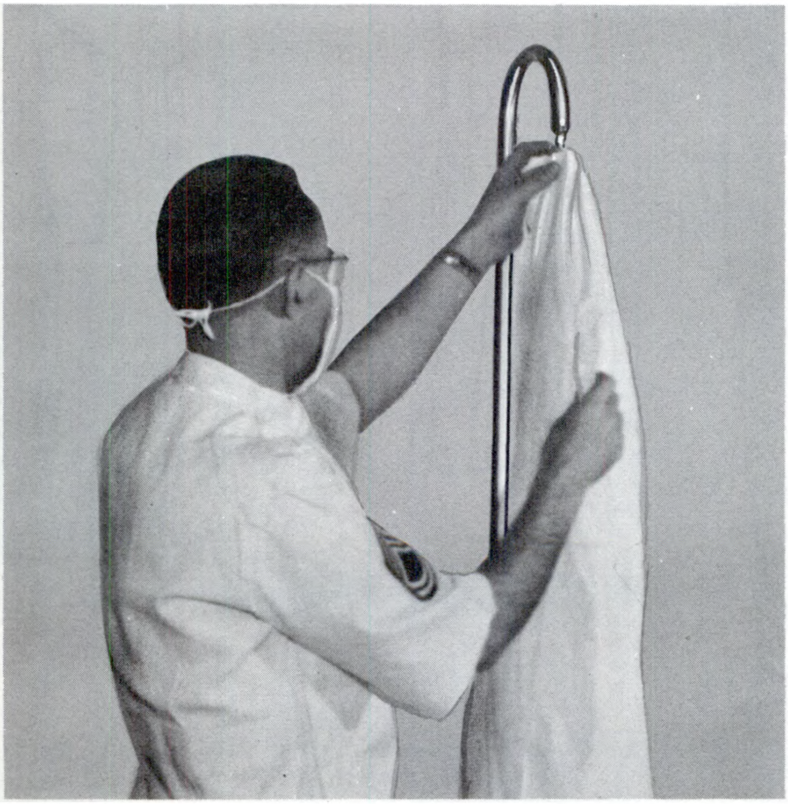


3 Removing cuff of the gown

Figure 157—Continued.



4 Removing the other cuff



5 Hanging the gown on the IV Standard

***Figure 157*—Continued.**

(*b*) Slide hands into sleeve openings and proceed to put on gown as described previously in *c* above.

(2) *Returning gown to standard.*

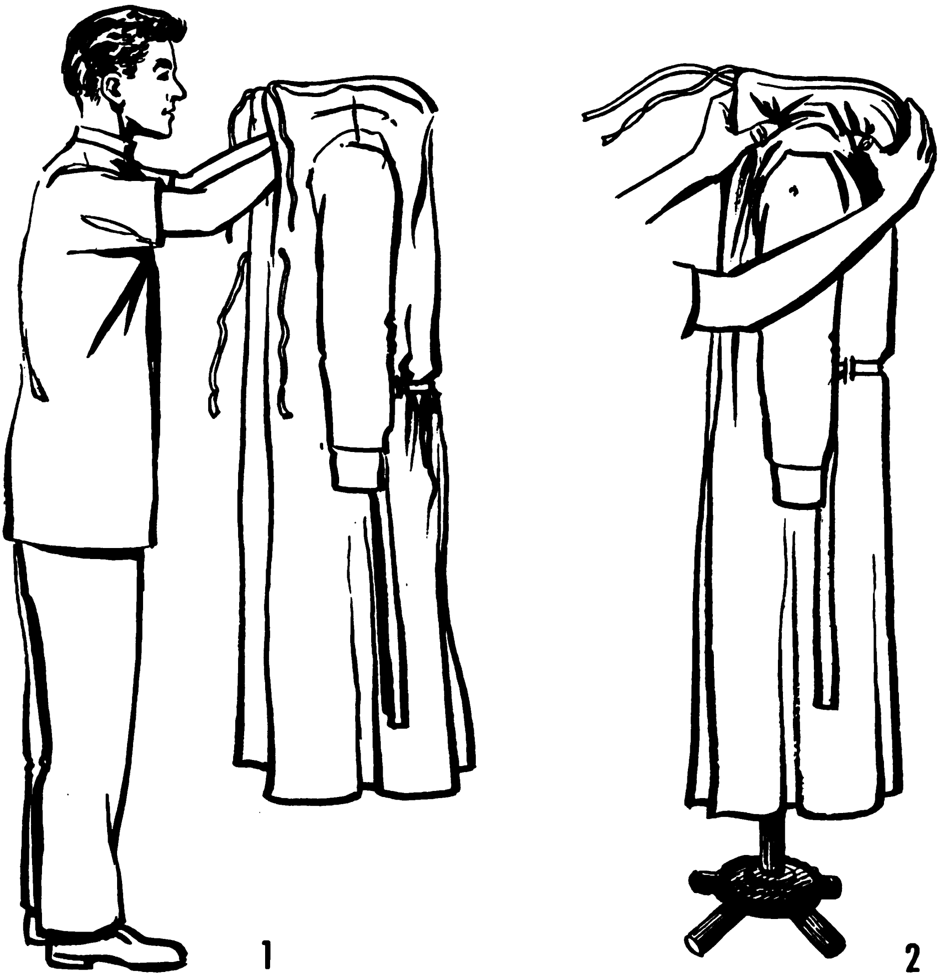
(*a*) Work hands out of sleeves and support shoulder seams with hands (as in procedure explained in *c* above).

(*b*) Bring hands together and grasp both shoulder seams on the inside with one hand.

(*c*) Remove opposite hand from shoulder and grasp neck ties at back of neckband.

(*d*) Release grasp on shoulder seams; push center of neckband out.

(*e*) Remove hand from inside of gown; grasp on outside and gather gown to shoulder seams and hang on hook, gown supported on outside portion of shoulder seams (2, fig. 158).



1 Removing the gown from the hook
2 Hanging the gown on the hook

Figure 158. ***Gown technique (re-use technique when gown is inside patient's unit).***

501. Glove Technique

If the use of gloves is indicated when you are handling highly infectious materials, follow this procedure:

a. Wash your hands.

b. Make sure gloves are clean and free from holes.

c. Put on gloves *before* entering unit.

d. After use, wash gloves under running water and send to the Centralized Materiel Section in a container marked "Contaminated."

502. Disinfection

a. Sterilization and Disinfection. These are different processes used for different purposes. *Sterilization* implies the destruction of all organisms, including the heat-resistant spores. This technique is used for all surgical equipment and supplies and for material to be used in the treatment of wounds in general. *Disinfection* is a procedure in which all but spore-forming micro-organisms are destroyed. *Concurrent disinfection* includes those procedures used to disinfect articles during the illness of the patient; *terminal disinfection* is accomplished after the patient is discharged and includes disinfection of the patient unit and articles used for the patient while he was in the hospital. Disinfection may be achieved by either physical or chemical means. The most effective of the physical means is burning and is used when possible. As it destroys the article, many contaminated objects must be disinfected by other means. Boiling an object vigorously for 30 minutes destroys all pathogenic organisms except spores. Chemical disinfection is the preferred method for those objects injured by heat (par. 424). Exposure to air and sunlight may be used for certain articles and equipment which would be injured by either heat or chemicals.

b. Choice of Method of Disinfection. In choosing the best method of disinfection for various sorts of equipment, you must take into consideration the composition of the articles concerned. Some general guides for disinfection of equipment follow; however, you must always check the standing operating procedure of the hospital as your final guide:

(1) Boil or steam sterilize anything that can be so treated, for example, dishes, bedpans, urinals, and rectal tubes. If you disinfect them by boiling, immerse them in boiling water for 30 minutes. Boiling is the most common method of disinfecting equipment.

(2) Place thermometers in the disinfectant recommended by the hospital for at least 10 minutes. Wipe stethoscopes with alcohol and a clean cloth and allow them to dry, or place them in the sun.

(3) If any article cannot be steam sterilized, boiled, or placed in a disinfectant solution, air it for 12 hours in the sunshine. This applies especially to gloves and other leather goods. All clothing is disinfected by Medical Supply or by dry cleaning, depending on the material.

(4) In dusting a room, use a damp cloth which has been moistened with the disinfectant recommended by the hospital.

c. Disinfection of Dishes.

(1) Plastic or paper tray covers, plates, cups, etc., are becoming more and more favored, since they can be destroyed after use.

(2) Disinfect china dishes by boiling. Any large covered container may be used. Remember that effective disinfection is obtained only when the dishes are submerged in boiling water.

(3) Scrape excess food from the dishes into a newspaper and burn it in the incinerator. Do not nest plates or saucers together; place them on edge and leave space between them for steam to circulate. Do not place cups or other deep dishes right side up in the chamber; place them on their sides so that water will drain from them.

(4) Cover the vessel and heat to boiling. Vigorous boiling should continue for at least 30 minutes.

(5) After the dishes are disinfected, return them to the kitchen to be washed.

(6) If facilities for boiling are not available on the ward, you may soak contaminated dishes in a disinfectant solution for at least 1 hour prior to sending them to the kitchen.

d. Disinfection of Urinal and Bedpan. After urine and feces are emptied, sterilize the bedpan in a steam sterilizer, or place it in a disinfectant solution as described in paragraph 383.

(1) *Bedpan and urinal sterilizer and washer.* In this apparatus a bedpan or urinal is first washed by a spray of cold water and then is exposed directly to a flow of live steam. Because the pan is close to the source of steam, and the container is relatively small, the period of exposure to steam is only 2 or 3 minutes (par. 383 and fig. 111).

(2) *Bedpan sterilizer.* Empty bedpans and wash with cold water. Then place several pans on the racks with their drainage outlets pointing down. Place washed urinals or similar utensils in the chamber so that any water drains out. The container is large, and several minutes must be allowed for the chamber to fill with steam. Disinfection should continue for 15 minutes after you have made sure that the chamber is filled with vigorously flowing steam (par. 383 and fig. 112).

e. Disinfection of Clothing, Mattresses, Furniture. Keep separate all linens and clothing from an isolation unit and send them to the hospital laundry in a bundle marked "Contaminated." Do not attempt to disinfect shoes or any type of leather with boiling water or steam. Water and steam ruin leather. Exposure to bright sunlight for several hours is usually considered an effective means of disinfecting books, furniture, rugs, mattresses, and other articles that would be injured by heat or chemicals. When possible, it is better to avoid contamination of those items which cannot be effectively sterilized by using plastic protectors on mattresses and pillows, and by using furniture made of metal and plastic. Further, avoidance of rugs in contaminated areas and the use of cheap paper backed books which can be economically destroyed should also be considered.

503. Caring for a Patient in an Isolation Unit

a. General Principles. In caring for a patient in an isolation unit you must know how to protect yourself by proper use of handwashing facilities, a mask, and a gown. You must also remember at all times which areas are considered contaminated and which areas are considered clean. Furthermore, you must know how to handle articles which are removed from or taken into contaminated areas. All contaminated articles removed from a patient's unit must be sterilized or disinfected as soon as possible. If it should be necessary to place a contaminated article on a clean surface, protect the surface with a clean newspaper or paper towel; disinfect and dispose of the article as soon as possible. Articles which are to be kept clean while in use within the isolation unit must not come in contact with the patient or the equipment within the unit.

b. Visitors. In some cases, visitors must be excluded from the isolation unit; in other instances, they may be admitted on a restricted basis and in accordance with hospital regulations. Visitors must be carefully instructed in using whatever protective measures are considered necessary (such as handwashing, mask and gown technique) and must be observed carefully to see that these instructions are carried out.

c. Preparing to Enter the Patient's Unit.

(1) Before you enter the unit, assemble any equipment which you might need, such as a wristwatch for taking pulse and respiration and a paper bag for soiled tissues.

(2) Wash your hands before approaching unit. Wash them in the utility room, where there is running water.

(3) Handle special equipment to be carried into the unit as follows:

(*a*) Place paper bag on table, with edge extending slightly beyond table. (Table will not be touched when you pick up the bag with contaminated hands.)

(*b*) Remove wristwatch and place it on a clean paper towel. Allow edge of towel also to extend beyond the edge of the table.

(*c*) Provide a clean area for the watch after leaving the unit by opening two paper towels and placing them together on the table.

(4) Remove all other jewelry. (If wedding band is not removed, give special attention to washing around it when you leave the unit.)

(5) Place jewelry in pocket, or pin it securely to uniform.

(6) Put on mask (par. 499).

(7) Put on gown. The gown is hanging *outside* the patient unit (par. 500*c*(1)). Hands are now contaminated.

d. Entering the Unit. When entering the isolation unit with a clean article, the article can be carried in on a clean paper towel.

(1) Reach under edge of paper towel and slide towel with watch from table into hand without touching the table. (Only the bottom side of the towel may now be touched. This side is now contaminated.)

(2) Pick up the paper bag by the edge which extends beyond the top of the table.

(3) Open the screen carefully, touching only the inside portion of the screen.

(4) Enter the unit and pull the screens closed, touching only the inside portion of the screen.

(5) Place paper bag on patient's bedside table.

e. Care of the Patient in Isolation.

(1) Take temperature, pulse, and respiration.

(*a*) Continue to hold (in one hand) the paper towel with the watch.

(*b*) Using the other hand, obtain the thermometer, and place it under the patient's tongue.

(*c*) Count pulse and respiration.

(*d*) After counting pulse and respiration, slide the paper towel with the watch on the bedside table. (The top side of the towel and the watch are still clean.)

(2) Change the paper bag of soiled tissue.

(*a*) Remove the bag from the bedside table.

(*b*) Grasp the bag under the turned down cuff.

(*c*) Unfold the cuff.

(*d*) Roll it closed.

(*e*) Place the bag to one side of the bedside table until you are ready to leave the unit.

(*f*) Put the clean bag into place.

(3) Before leaving the unit, check to see if there is anything else to be done. Frequent duties might include—

(a) *Handling linen.* Linen from patient's bed should be removed by rolling it carefully with as little agitation, shaking, or flapping as possible. It should then be rolled in a tight bundle and placed outside the unit in a linen hamper marked "Contaminated." Care should be taken not to touch the screen nor the outside of the hamper with the linen. If clean linen is needed, request someone in the clean area to bring it to you.

(b) *Cleaning and ventilating the unit.* When daily dusting or mopping is done, use a damp dust cloth or a mop. Ventilate the unit daily or whenever necessary.

f. *Leaving the Patient's Unit.*

(1) Carefully slide the paper towel with the watch on it on one hand. Do not touch the top side of the towel or the watch.
(2) With the other hand, pick up the paper bag of soiled tissues.
(3) Push the screen open, touching the inside of the screen only.
(4) After leaving the unit, use your foot to slide the screen closed.
(5) Dispose of the bag of tissues in a step-on can.
(6) Place the paper towel with the watch (bottom of which is contaminated) on the opened clean towel on the table.

g. *Removal of Gown and Mask* (pars. 499 and 500*c*).

h. *Final Steps.*

(1) Replace watch and jewelry.
(2) Discard paper towels on the table into the step-on can, touching only the bottom side of the opened paper towels.

504. Entering the Patient's Unit With a Mask Only

a. *Situations When This Procedure is Used.* For very brief visits into the isolation unit, when no physical contact with the patient is to occur, the mask is the only protection needed (*for example:* delivering mail, taking in nourishment or a food tray, asking the patient a question).

b. *Procedure.*

(1) Don the mask (par. 499).
(2) Carry the glass of juice in one hand.
(3) Open the screen with other hand, touching the outside (clean portion) of the screen only.
(4) Place the glass on the patient's bedside stand (the glass is to be picked up later by the patient).
(5) Leave the unit.
(6) Close the screen, touching the outside only.
(7) Remove the mask (par. 499).
(8) Wash the hands before going to the next patient.

505. Procedure When All Equipment Is Inside the Patient's Unit

a. Equipment.

(1) Place all equipment inside the patient's unit.

(2) The same equipment will be needed and the same principles followed.

b. Gown.

(1) Hang gown with clean side turned in; the contaminated side is exposed to patient's unit.

(2) Refer to paragraph 500*d* for gown technique.

Section II. CARE OF PATIENTS WITH COMMUNICABLE DISEASES

506. General

Communicable diseases are those which may be carried directly or indirectly from one person or animal to another. Direct transmission is by actually touching the infected person or animal; indirect transmission is by touching contaminated objects. Communicable diseases are usually classified according to portals of entry and exit of the micro-organisms causing the disease: respiratory, intestinal, arthropod-borne, and diseases transmitted by miscellaneous other means.

507. Portals of Entry and Exit of Micro-organisms Which Produce Communicable Diseases

a. The Respiratory Tract. The most common portal of entry and exit of micro-organisms in the respiratory tract. Micro-organisms leave the body of the infected person by means of droplets and by nose and throat secretions. Droplets are exhaled in coughing, sneezing, talking, or just breathing. These droplets do not fall to the ground immediately but remain suspended in the air for many hours and can be inhaled by a well person, who may then become infected with the disease. The infection may also be spread to a well person who improperly handles secretions of the nose and throat of the patient.

b. The Gastrointestinal Tract. Communicable disease organisms can also leave the body of the ill person through feces. These organisms may then enter the body of a well person who eats contaminated food or drinks contaminated water. Contamination may also be spread by the hands to the mouth after handling contaminated feces.

c. Mucous Membrane and Skin. Communicable disease organisms can leave the body of the ill person through infectious lesions and enter the body of the well person through cuts or small breaks in

the skin. For example venereal disease (such as syphilis and gonorrhea) and skin infections (such as impetigo) are spread in this manner. Direct contact is usually the method of transmission.

d. Inoculation into the Blood Stream. Insects or animals that bite infected persons can transmit to well persons they bite certain disease organisms such as malaria, tetanus, and rabies. Disease organisms can also be transmitted from one person to another by contaminated needles and syringes. Furthermore, blood from a wound of the infected person can transmit disease organisms by coming into contact with open cuts or wounds on a well person.

508. General Measures for Controlling Communicable Diseases

a. Community Sanitation. The control of communicable diseases may include local, state, national, or international regulations, and these regulations frequently involve the departments of preventive medicine and the public health service. One of the most important aspects of control of infectious diseases is the provision of a sanitary environment. This includes insect and rodent control; inspection of food, milk, and water; and garbage and sewage disposal.

b. Education of the Public. Reporting communicable diseases is the responsibility of the doctor, but it is the responsibility of everyone to report to the doctor or the proper public health official anyone he has reason to believe is suffering from an untreated communicable condition. It is also the responsibility of everyone to inform himself of the methods of transmission of communicable disease organisms so that he can take measures to protect himself and others from infection. Good personal hygiene including body cleanliness, adequate rest, and a well-rounded diet will go far to strengthen the body's defense against disease. Avoiding crowded areas during periods of epidemic will also help. Furthermore, to aid in preventing spread of communicable disease, each individual should cover his mouth and nose when coughing or sneezing and should carefully dispose of all tissues containing droplets or nose and throat secretions.

509. Nursing Care of Communicable Respiratory Diseases

a. General. Many respiratory diseases are infectious in type and are easily spread. Besides isolation technique (par. 496), chemotherapy and good nursing care are curative factors. Good nursing care includes knowledge of the duration and stages of the disease, techniques of isolation appropriate to the case, concurrent and terminal disinfection, comfort measures for the patient, knowledge of diagnostic tests and specimens required, therapeutic measures usually ordered, observation of special signs and symptoms, and complications which may occur.

b. Nursing Care of Common Respiratory Conditions.

(1) Common respiratory disorders include the common cold, sinusitis, tonsillitis, laryngitis, bronchitis, and pleurisy. They usually cause one or more of the following conditions: nasal congestions, headache, sore throat, fever, hoarse cough, foul taste in mouth, pain in throat and chest, difficult breathing, malaise, and lack of appetite.

(2) As a specialist caring for the patient, you must wash your hands after touching him or anything he has touched. Instruct him to cover his mouth with tissue wipes when he is coughing or sneezing. Ask him to discard used tissue wipes in the paper bag fastened to his bed. Dispose of these carefully (par. 502) to avoid the spread of infection. Protect the patient from temperature fluctuations in the room. Change his linen and pajamas as soon as possible when they are damp.

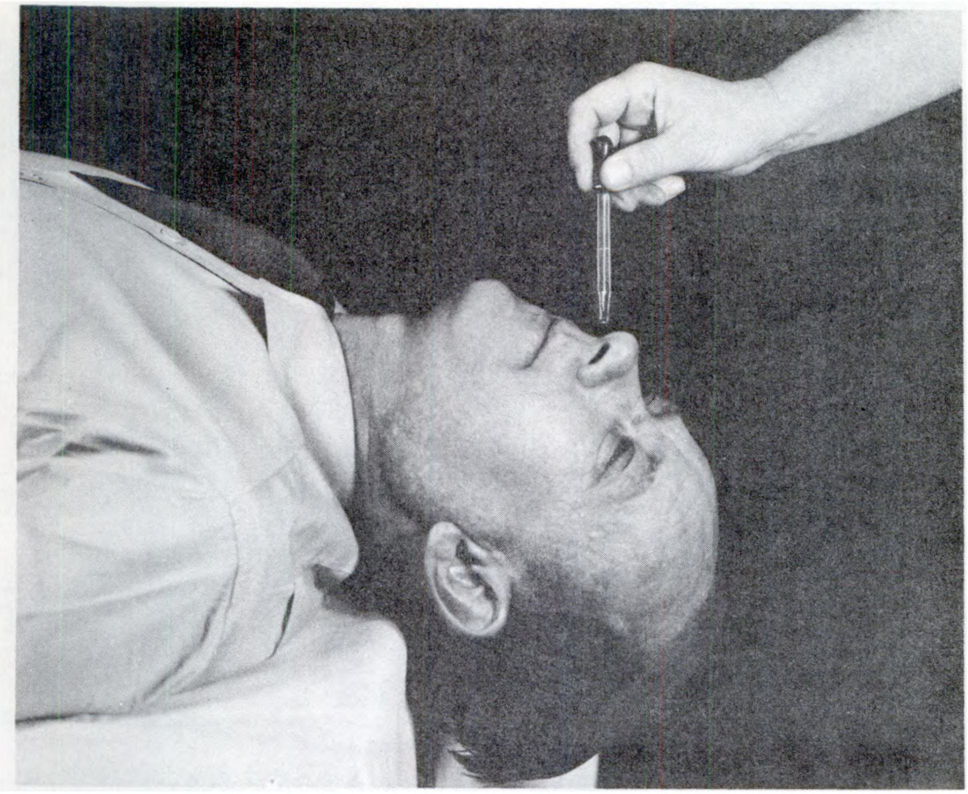
(3) Measures which are helpful in making the patient comfortable are elevation of his head (semi-Fowler's position) for easier breathing, frequent changes of position, and frequent oral hygiene.

(4) Treatment ordered by the doctor may include administration of nose drops for nasal congestion, irrigations and inhalations for throat and chest pain and congestion, and medication for fever and for infection.

(5) If the doctor orders that the patient be encouraged to cough frequently in order to remove secretions, instruct the patient to cover his mouth while he is coughing, and to cough as deeply and as often as possible. If coughing is painful to him, support the painful area with one hand and place the other hand directly anterior or posterior. Exerting a gentle, firm compression as the patient coughs will increase the effectiveness of the procedure. When you cannot be with him, tell him to lie on his affected side when coughing, as this will give additional support of the painful area.

c. Common Respiratory Treatments.

(1) *Nose drops and sprays.* Vasoconstrictor drugs are instilled into the nostrils to shrink the nasal mucosa. This is done to open respiratory passages and to allow better drainage of the paranasal sinuses. A vasoconstrictor solution may be sprayed into the nose with an atomizer or injected with a medicine dropper. If you use the medicine dropper, place the patient in a head-down position, his head either between his knees or hanging over the edge of a table (1 and 2, fig. 159). Place three or four drops of the solution in each nostril, then have the patient remain in position for several minutes.



1 Patient on table

Figure 159. Instilling nose drops.

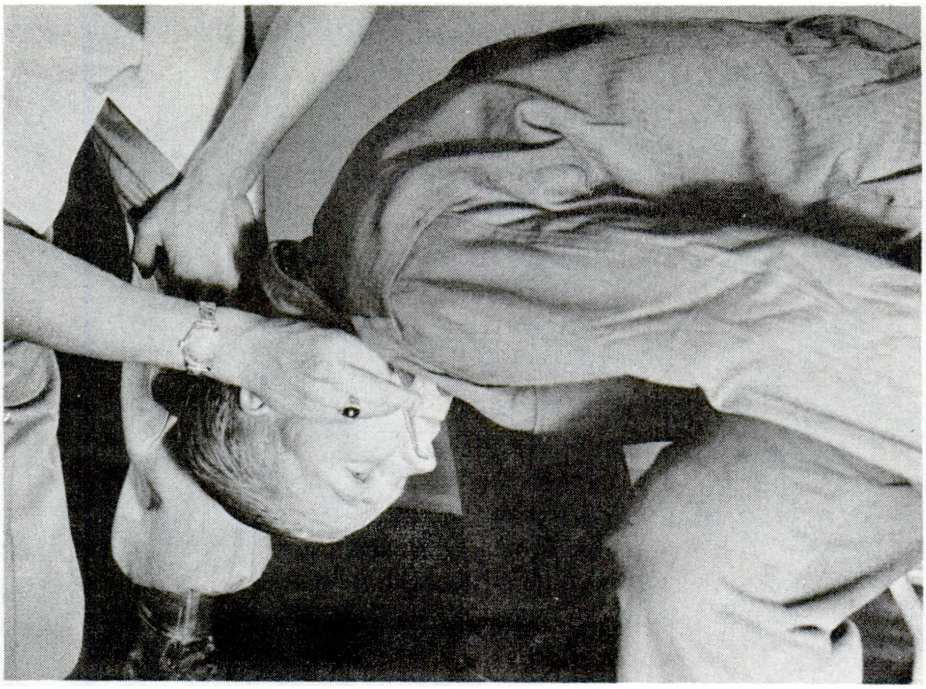
(2) *Steam inhalations.* See paragraph 472.

(3) *Throat irrigations.*

(*a*) The purposes of washing out the oral pharynx by a stream of liquid are to soften the mucus and to remove accumulated secretions; to relieve congestion and pain; and to stimulate circulation. Throat irrigations are generally considered to be much more effective than gargling. The type of solution and the duration and frequency of the treatment are ordered by the medical officer.

(*b*) Explain the purpose of the irrigation and the method of giving it to the patient. He may prefer to direct the stream of liquid himself. To get the best results the stream must be directed toward the affected parts without making the patient gag. Gagging may cause him to swallow or aspirate some of the solution.

(*c*) Have ready the following equipment: a rubber treatment sheet, a towel, a box of tissues, an emesis basin, or large basin, an irrigating can with a rubber tube and tip, and a flask of the solution ordered by the doctor.



2 Patient with head between knees

Figure 159—Continued.

(*d*) Place the patient in a sitting or recumbent position, and fasten the rubber treatment sheet and the towel around his neck. Give him several tissue wipes. Place the solution (which has been warmed to the desired temperature) in the irrigating can, remembering first to fasten the clamp so that the solution will not run out until needed. Place the emesis basin in position. If the patient is sitting up, place the basin on a table and let him lean over it. If he is lying down, turn his head so that his cheek is on the edge of the pillow. Have him turn his head to the other side for half of the treatment so that the entire throat can be irrigated. Hold the irrigating can about 12 inches above the patient's head and allow a small amount of the solution to run into the emesis basin. Show the patient how to cut off the flow and let him try doing it, if he is going to help with the irrigation. Assure him that the irrigation can be stopped whenever necessary for him to breathe or rest. Instruct him to hold his breath and to direct the flow of solution over the affected parts. As he acquires confidence, urge him to hold his breath for longer intervals and to direct the flow of solution farther back into the pharynx. Empty the emesis basin as often as necessary to prevent spilling or use a large wash basin.

(4) *Gargles.* Gargles are employed for certain disorders of the throat. They may be used for cleansing, soothing, or antiseptic purposes, and the solution may be hot or cold. Caution the patient not to swallow the solution. Encourage him to allow the solution to reach back as far as possible into the pharynx. Observe him carefully and report any difficulty or undue fatigue to the doctor. The patient may be instructed to gargle his throat with hot salt water every 3 or 4 hours. Impress upon him that the heat and frequency are the most important points of this treatment and that the water should be as hot as he can tolerate it. The gargle should consist of half a teaspoonful of salt to a glass of water.

510. Communicable Intestinal Diseases

In communicable intestinal diseases the infectious agent is eliminated from the body in the feces, vomitus, or urine. It may be transmitted to others by means of contaminated milk, food, utensils, or fingers; usually the infectious agent must be swallowed for infection to occur. Examples of this group of diseases are typhoid fever, amoebic and bacillary dysentery, and cholera.

511. Arthropod-Borne Diseases

In most of the arthropod-borne diseases isolation technique is relatively simple, as the main object is to keep the disease from being transmitted to mosquitoes, fleas, lice, etc., which in turn transmit the infection to people. In some of these diseases (plague, for example), additional measures must be observed as the infectious agent is also found in the droplets from the respiratory system. More has been done to prevent these diseases from occurring than to cure them once they are contracted. Though some drugs are now being used with beneficial effects, good nursing care is still the principal factor in the patient's recovery.

512. Miscellaneous Communicable Diseases

The miscellaneous communicable diseases are those whose infectious agents are transmitted by means other than those mentioned in paragraph 507. Among these diseases are tetanus, poliomyelitis, athlete's foot, and viral hepatitis.

Section III. NURSING CARE OF THE PATIENT WITH DISORDERS OF THE EYE

513. Psychological Considerations

a. General. Patients who are suffering from disorders of the eyes, and especially those who are wearing a bandage over one or both

eyes frequently feel insecure, overly dependent upon others, and fearful of permanent damage to their eyesight. This insecurity and fear may make them reluctant to receive treatment from unfamiliar medical personnel, even though the disorder of their eyes is a minor one. You must use much tact and understanding in caring for these patients and make every effort to reassure them.

b. Method of Approaching Patients Who Have Both Eyes Bandaged. One of the most important considerations in the care of a patient who has both eyes bandaged is your method of approaching him. Quietly address the patient *by name* as you approach him. Then explain exactly what you are going to do before you touch him. Orient him as to your immediate presence by placing your hand on his shoulder or arm. Be sure that all your movements are gentle, precise, and skilled.

514. Physical Considerations

a. The Conjunctiva. In treating the eye you should remember a few basic facts concerning its structure. The *conjunctiva*, (the mucous membrane which covers the front portion of the eyeball and lines the eyelid) absorbs medication placed in the eye. The blink reflex of the eyelid causes the eyelid to close automatically when something is dropped into the eye. Some effective method, therefore, must be used to control this reflex so that the medication will come into contact with the conjunctiva.

b. The Tear Glands. Another physical consideration in treating the eye is the action of the tear glands. Tears produced by these glands wash across the surface of the eye and drain into the nose through the tear duct located in the inner corner of the eye. Tear glands usually become more active when eye infections or injuries are present and care must be taken to prevent infection from spreading from one eye to the other.

515. Treatment Procedures for the Eye

a. Precautions. In order to perform all of the procedures described in *b* through *e* below, with the greatest degree of safety and comfort to the patient, you should understand and apply various precautions. Proper positioning of the patient in eye treatments is of great importance to insure that you have his head under control and that his eye is properly opened. If a patient is seated in a chair, stand behind him to give support to his head; if he is in bed, the bed supports his head. To prevent injury, brace your hand, in which you are holding the syringe or dropper, on the patient's forehead. This technique prevents your hand from shaking while you instill drops or irrigate the eye and keeps you from injuring his eye should he move his head suddenly, because the dropper or syringe will move with his head. With your hand in this position, you can

flex your wrist and bring the dropper or syringe within close range of the eye and parallel to it without danger of touching the eye (fig. 160). To prevent spreading infection, always tilt the patient's head toward the affected side and direct the flow of solution from the inner toward the outer canthus (corner). Take care not to touch the conjunctiva.

b. Instillation of Eye Drops. Eye drops are instilled for examination of the eye or to treat infection, disease, or injury. Have ready the eye drops (as ordered by the doctor) and a box of tissue wipes. Instruct the patient to sit in a chair (unless he is unable to do so) and explain to him what you are going to do. Always wash your hands thoroughly immediately preceding treatment, and be sure that your fingernails are short and clean. Check the medication for accuracy and then draw out the prescribed number of drops in the dropper. Avoid inverting the dropper as there is danger that small particles from the rubber part might become mixed with the medication. Stand behind the patient and brace his head against your body. Tilt his head toward the affected side. Place your thumb that is nearest his affected eye below his lower eyelid. Then instruct him to look up in order to control the blink reflex. Place the wrist of your other hand (the one holding the dropper) on the patient's forehead. Be sure to hold the dropper *parallel* to the eye. Bring the tip of the dropper close to the pocket of his lower eyelid. Now instill the prescribed number of drops on the pocket of the lower

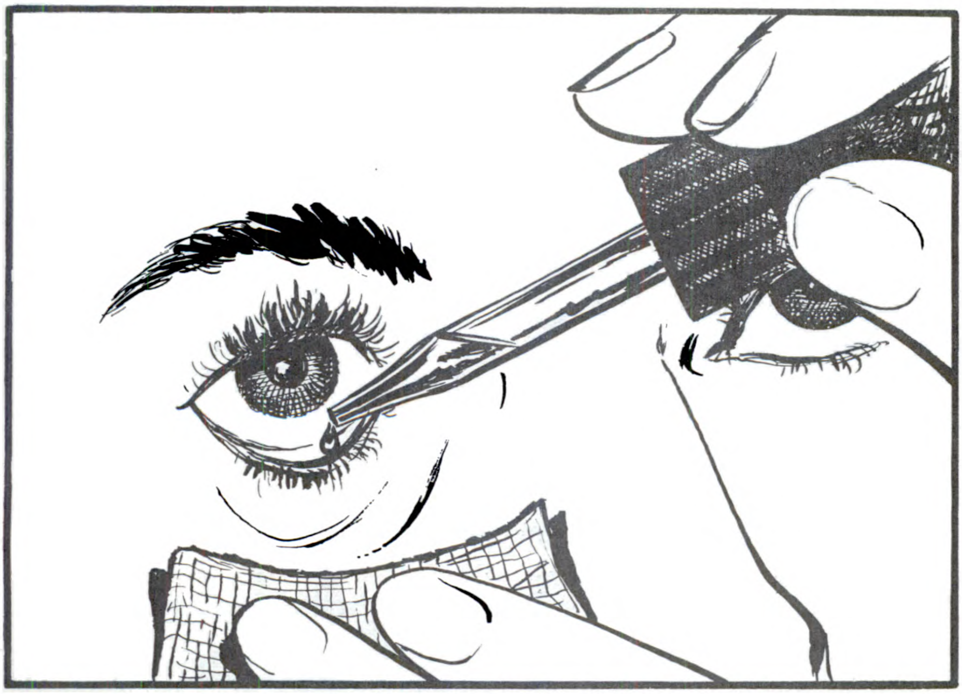


Figure 160. Instillation of eyedrops.

lid. Instruct him to close his eyes and roll his eyeballs in order to distribute the drops evenly.

c. Instillation of Eye Ointments. Eye ointments are frequently ordered to treat infection, disease, or injury. Have ready the tube of the correct eye ointment (as ordered by the doctor) and check it to see that it has "Ophthalmic" on the label. This word indicates that the ointment is to be used for eyes only. Have ready also a box of tissue wipes, a sterile container of 2 x 2 gauze sponges, and transfer forceps in a container of solution. Wash your hands and check to be sure your nails are clean and short. Using the transfer forceps, remove a 2 x 2 gauze sponge from the container and grasp one side of the gauze sponge with your fingers. Now remove the cap from the tube of ointment and squeeze out a small amount on the gauze sponge to eliminate the hard crust which might have formed on the surface. Discard this gauze sponge in the waste container. Position and prepare the patient as in *b* above. Apply a thin ribbon of the ointment on the pocket of the lower eyelid. Instruct the patient to close his eyes and to roll his eyeballs in order to distribute the ointment evenly. Replace the cap on the ointment. If necessary, blot off the excess ointment on the eye with a tissue wipe.

d. Eye Irrigations. These are used to wash or cleanse the conjunctiva with a sterile solution. The following equipment is needed: a sterile basin for the solution, a sterile irrigating syringe with a protective rubber tip, a drape towel and rubber treatment sheet, safety pins, emesis basin, tissue wipes, a jar of cotton pledgets, and a flask of the sterile solution ordered by the doctor. Heat the solution to 100° to 105° F. by placing the flask in a basin of warm water. Have the patient in a sitting position, if possible, and explain the procedure. Wash your hands. Pin the towel with the rubber treatment sheet around the patient's neck. Remove with your fingers a cotton pledget from the jar. Moisten it by pouring over it a small amount of the irrigating solution and wipe away the excess secretions in the eye. Discard the pledget in the waste container. Use as many cotton pledgets as necessary to clean the eye, but use each one only once and discard it. Now unwrap the sterile basin and the irrigating syringe and place the syringe in the basin. Test the irrigating solution by pouring a small amount over the inner surface of your wrist. The solution should feel slightly warmer than body temperature. Place the emesis basin under the eye that is to be irrigated and show the patient how to hold it in place. Position the patient as in *b* above, and draw up a syringe full of solution. Holding the irrigating syringe parallel to his forehead, bring the tip close to the inner canthus of the eye. Direct a steady, gentle flow of the solution from the inner to the outer canthus. Do not use pressure. Continue the irrigation until the prescribed amount of solution has been used.

Blot off the excess solution with a tissue wipe. Clean the equipment and return it to the Centralized Materiel Section.

e. Eye Dressing. If the medical officer has ordered that an eye dressing be applied to both eyes in order to provide immobilization for the affected eye, obtain the following equipment: 2 sterile eye dressings (either commercial or improvised), about 10 strips of 1″ x 5″ adhesive (or Scotch tape). Wash your hands, seat the patient, and explain the procedure. Remove the eye dressing from the sterile container. Instruct the patient to close both eyes. Place the sterile side of the dressing on the affected eye and ask the patient to hold it in place with the tip of one finger. Place the first strip of adhesive diagonally across the center of the dressing, extending it from the brow to the cheek. Alternate other strips of adhesive first on one side and then on another of the center strip, overlapping each strip slightly until you cover the entire dressing. Turn back the uneven edges and trim the ends. Apply a dressing to the other eye in the same manner.

516. Special Nursing Care for the Patient

a. The Patient Able To Move About in Bed, or Sit in a Chair Beside the Bed. Orient the patient to the placement of equipment on the bedside table, location of slippers, robe, and chair. Remove matches or sharp tools from the patient's reach. Caution him not to lean forward, as this position may cause pressure on the eyeballs. When he is first able to walk about with his eyes bandaged, assist him and orient him to nearby surroundings such as the latrine, the day room, etc. Try to keep all furniture and equipment in the same place at all times. Avoid leaving doors half open.

b. The Patient on Complete Bed Rest. For this type of patient the medical officer may order complete immobilization of the patient's head. Place sand bags or small pillows on each side of the patient's head and caution him against any sudden movement such as coughing, sneezing, or vomiting. Bed rails are frequently used. These rails and the head of the bed may need to be padded to protect the patient from injury. Avoid jarring or bumping the bed when you approach it and do not startle the patient in any way; any sudden motion may break small eye sutures or cause extreme pain.

Section IV. CARE OF THE PATIENT WITH DISORDERS OF THE EAR

517. General Rules

Patients with ruptured ear drums or with middle-ear infections are treated by the medical officer. As a medical specialist you will be asked to perform only very simple procedures such as instillation of ear drops, placing a cotton pledget in the vestibule of the ear, and

ear irrigation. As in the procedures described in paragraphs 513 and 514, you must take certain precautions to prevent injury to the patient and to perform the procedure with the greatest comfort to him.

518. Treatment Procedures

a. Instillation of Ear Drops. Besides the ear drops ordered by the medical officer, you will need a jar of cotton pledgets. Wash your hands. Have the patient in a sitting position, if possible, and explain the procedure. Check the medication for accuracy and draw up into the dropper the prescribed number of drops. Do not invert the dropper as small particles of rubber might become mixed with the medication. Standing behind the patient tilt his head so that his affected ear is turned upward. Brace his head against your body and with the hand nearest his affected ear pull external ear up and back. Place the wrist of your other hand (the one holding the dropper) on the patient's forehead. Hold the dropper parallel to the patient's head and direct the tip of the dropper toward the vestibule of the ear. After instilling the required number of drops, replace the dropper in the bottle of medication. Take out a cotton pledget with your fingers and place it in the vestibule of the ear canal. Try to adjust the cotton pledget to the proper size to fit neatly and firmly in the vestibule, but do not push it in deep. The purpose of the pledget is not to serve as a plug, but as a wick.

b. Ear Irrigation. This treatment is used to wash out the outer ear, usually to remove wax. You will need the following equipment: a sterile basin for the solution, an irrigating syringe, a towel and a rubber treatment sheet, a safety pin, an emesis basin, a jar of cotton pledgets, and a flask of the solution ordered. Heat the solution to about 100° to 105° F. by placing the flask in a basin of warm water. Wash your hands. Seat the patient and explain the procedure you are about to use. Pin the towel and the rubber treatment sheet around the patient's neck. Unwrap the sterile basin and pour the sterile solution in it. Unwrap the irrigating syringe and place it in the basin. Test the irrigating solution by pouring a small amount of it over the inner surface of your wrist. It should feel slightly warmer than body temperature. Place the emesis basin under the ear to be irrigated and ask the patient to hold the basin in place. Draw up a syringe full of solution. Position the patient, tilting his head on the affected side downward over the emesis basin. Pull back the external ear with one hand and place the wrists of the hand holding the syringe on the patient's forehead. Direct the tip of the syringe toward the wall of the ear canal, leaving sufficient room at the vestibule to allow for the return flow. Irrigate the ear gently, directing the flow of the solution toward the posterior wall of the canal. Continue the irrigation until you have used the prescribed

amount of solution. If the patient complains of nausea, pain, or dizziness, or if you see blood in the return flow of the solution, discontinue the treatment. Insert a cotton pledget as in *a* above. Clean all equipment and return it to the Centralized Materiel Section.

Section V. NURSING CARE OF THE ORTHOPEDIC PATIENT

519. Meaning and Scope of Orthopedics

Orthopedics is the science of the prevention and correction of deformities and the treatment of disease of the bones, muscles, joints, and fasciae, either by manipulation, by special apparatus, or by surgery. In addition to the usual nursing techniques, therefore, orthopedic nursing requires certain special knowledge and skills. To give good nursing care to the orthopedic patient, the medical specialist should understand body mechanics, basic principles of physical therapy, specialized nursing procedures necessary in the treatment of this type patient, and preparation and use of special equipment such as splints, casts, traction devices and turning frames.

520. Common Orthopedic Conditions

Common orthopedic conditions are as follows:

a. Fractures.
b. Dislocations.
c. Sprains.
d. Bone diseases.
  (1) Osteomyelitis.
  (2) Tuberculosis.
e. Joint diseases.
  (1) Arthritis.
  (2) Inflammation.
f. Injury to the central nervous system.
  (1) Poliomyelitis.
  (2) Trauma or battle injury damaging the spinal cord and resulting in hemiplegia (paralysis of half of the body), paraplegia (paralysis of the lower portion of the body), or quadriplegia (paralysis of the arms and legs).

521. The Challenge in Caring for the Orthopedic Patient

The challenge in orthopedic care is two-fold. First, routine nursing care is difficult to give when a patient is in a cast or in traction. You will have to devise ways to carry out some procedures with the least possible disturbance to these orthopedic devices. Second, the patient himself presents a challenge. Because of his long hospitalization, his immobility, his fear of deformity, he may become unduly depressed or discouraged. Your understanding and encouragement can do much to support his morale. Encourage the patient to do as

much for himself as possible. Give him help only when he asks for it and only if he needs it, as he should be taught to be self-reliant. See that he takes part in group activities on the ward and that he has occupational therapy.

522. Devices Used in Caring for the Orthopedic Patient

New orthopedic devices are constantly being put into use, but all of them are directed toward the two-fold aim: to provide support for the injured part until it heals; to prevent deformity and stiffness of the injured muscles and joints. Support for the injured part may be provided by bandages, adhesive strapping, splints or plaster casts applied externally; or support may be applied directly to a bone by using pins or plates. To prevent stiffness the patient must use the affected part as much as possible within the limits ordered by the doctor. Physiotherapy is usually begun as soon as possible and it may be continued for an extended period of time following the healing of the affected part. Frequently, the patient needs the support of a brace or of crutches for sometime after he becomes ambulatory.

523. General Nursing Care for All Orthopedic Patients

a. Skin Care. Besides routine nursing care, the orthopedic patient needs special skin care. Since he is often confined to his bed and in many cases is immobile because of a cast or traction, he is particularly susceptible to bed sores. Change the patient's position each 2 to 4 hours; give frequent alcohol rubs; use rubber rings, sponges or rubber pads to change the area of pressure; provide a smooth, clean, dry bed.

b. Diet. At first the orthopedic patient may have little or no appetite. He may even have to be fed through a tube or intravenously. As his appetite increases and he is able to be fed or to feed himself, make his tray attractive. Think of topics to discuss with him as you feed him so that his attention is not focused on his eating. The diet selected for him usually is high in calories (about 3,500) and high in protein.

c. Elimination. A special effort must be made to prevent urinary complications. If the urine output is unsatisfactory or if infection occurs, the doctor may order bladder irrigations or tidal drainage. If enemas are necessary, give them at the same time every day to establish routine bowel movement.

524. Care of the Patient in a Cast

a. Purpose of a Cast. A cast is applied to a patient to maintain a part of his body in a certain position and to immobilize the bone and soft tissues. The cast is usually applied in a special cast room near the operating room.

b. Method of Handling a Wet Cast. If the cast is wet when the patient is brought from the cast room, handle it carefully while it is drying so as to maintain the affected part of the body in proper alinement. Prepare either a fracture bed with a firm mattress resting on boards or a commercial fracture bed. Move the cast by supporting it on rubber-covered pillows or on the palms of your hands. Be careful not to use your fingers, as they will leave indentations which may cause pressure when the cast hardens. While the cast is still wet, carefully check the extremities for signs of tightness of the cast. Dry the cast by exposing it to the air or sunlight or by using a heat cradle or a cast dryer. The cast usually requires about 48 hours for drying.

c. Nursing Care. When the cast is dry, cover the rough edges with stockinette or adhesive to prevent crumbling of the plaster. Tuck waterproof material under the edges of the cast and tape the material in place. Waterproofing the cast with shellac or varnish will help to keep it clean as it can then be wiped with a damp cloth. Never wash the cast; excess water damages it. Discomfort from itching can be relieved sometimes by "scratchers." These are strips of gauze or cotton bandages placed lengthwise over the skin before the cast is applied. They extend above and below and are tied together over the cast. When itching occurs, these ends may be untied and the strip moved back and forth, creating friction and relieving the itching. The strips may be replaced when they are soiled by tying on a fresh strip and pulling it under the cast as the old one is pulled out. In the same way, gauze strips soaked in alcohol can be pulled through to relieve itching. Take special care to maintain cleanliness of genitalia if the cast is in that area. Elevate the back and shoulders of the patient when placing the bedpan or the urinal so that moisture will not run back under the cast. Support him with pillows when he is on the bedpan.

d. Observation of the Cast Patient. Check the exposed extremity for the impairment of circulation. Watch for signs of swelling, cyanosis, numbness, coldness, pallor, or blanching. Report immediately any of these symptoms. Check also for signs of infection or complication: musty odor, pain, burning sensation, or elevated temperature. Check for pressure areas. If the patient complains that his cast hurts him, report it at once. Change his position frequently, if possible, and remember to maintain good body alinement. Encourage him to exercise to the greatest extent possible as exercise will maintain muscle function.

525. Care of the Patient in Traction

a. General. Traction means the exertion of pull by means of weights and pulleys. Counter traction (exertion of pull in the opposite direction) must be present to maintain body alinement. Traction

is used to promote and maintain alignment of broken bones. It is applied to the skin or to the bone. It is maintained by the use of a special frame on the bed (the Balkan frame).

b. Care of Traction Apparatus. Although the specialist does not change the traction, he is expected to check continually on the traction apparatus and to report any defect at once. The following questions concern points which he should observe as he attends the patient:

(1) Is the rope dragging on the bed or covers?
(2) Is the bag of weights resting on the floor or against the bed?
(3) Is a rope off its pulley?
(4) Has the patient slid down in his bed?
(5) Is the splint crooked?
(6) Has the splint slipped off the ischium, in the case of a Thomas leg splint?
(7) If there is a cast, is it causing pain?
(8) Is the cast broken?
(9) Are there plaster particles under the cast on the skin?

526. Care of the Patient in a Turning Frame

a. Advantages of the Turning Frame. Patients who have had an injury to the spine or spinal cord or surgery in this area, patients who have had extensive burns, and post polio patients who are paralyzed are frequently placed in a turning frame. In this device they may be turned without disturbing an immobilized trunk or spine. Nursing care is more easily given.

b. Stryker Frame and Foster Bed. Two turning frames in wide use today are the Stryker turning frame (fig. 161) and the Foster reversible orthopedic bed (fig. 162). Both are double frames which can be rotated on the longitudinal axis. Their operation is similar in principle; their chief difference lies in the provision made in the Foster bed for adjustment for hyperextension, while in the Stryker frame separate hyperextension frames are required. The Foster bed is much heavier than the Stryker and takes care of larger patients. Both beds can be elevated at either the foot or the head end to provide traction, and both have a rotary-bearing pulley traction apparatus at each end to maintain traction during the turning process. The patient is sandwiched in between two frames when he is turned. The frame on which he lies prone is called the *anterior* frame; the one on which he lies supine is called the *posterior* frame. Both frames are fitted with canvas which is laced on tightly to the metal framework. They have middle sections which can be removed when the bedpan is used. The anterior frame cover extends from just below the shoulder girdle to the ankles and is divided into two sections. The forehead is supported by a padded canvas strip or a

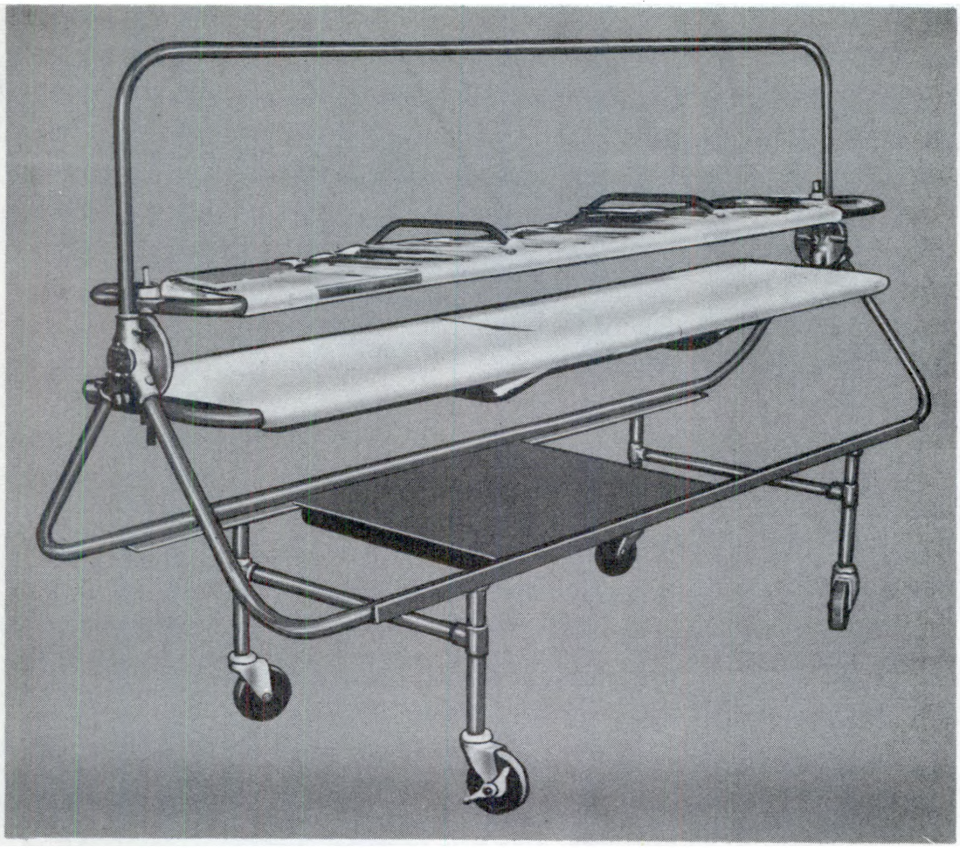


Figure 161. Stryker turning frame.

folded towel. The lower section of the canvas extends from four inches below the symphysis pubis to the internal malleolus, leaving the feet free. The posterior frame covers are also divided and leave a 4 to 6 inch perineal opening which corresponds to the opening left in the anterior cover. A removable buckle strap which supports the open space should be kept in place at all times except when the bedpan is being used. A footboard, used to support the feet when the patient is in the supine position, prevents foot drop and maintains good foot alinement. When the patient is in the prone position, his feet should hang free and perpendicular to the floor.

c. Turning the Patient (*Stryker Frame*).

(1) *From prone to supine.* The patient should be told when he is going to be turned and in which direction. Remove the bed clothing, foot supports, and arm rests. Clamp and detach any drainage tubes. Place pillows over the lower extremities to prevent the legs from slipping during the turning process. Remove the round nuts and lower the second frame, fitting the patient snugly between the two frames. Place turning straps around the frames at the level of the elbows, hips, and knees. Tell the patient to grasp

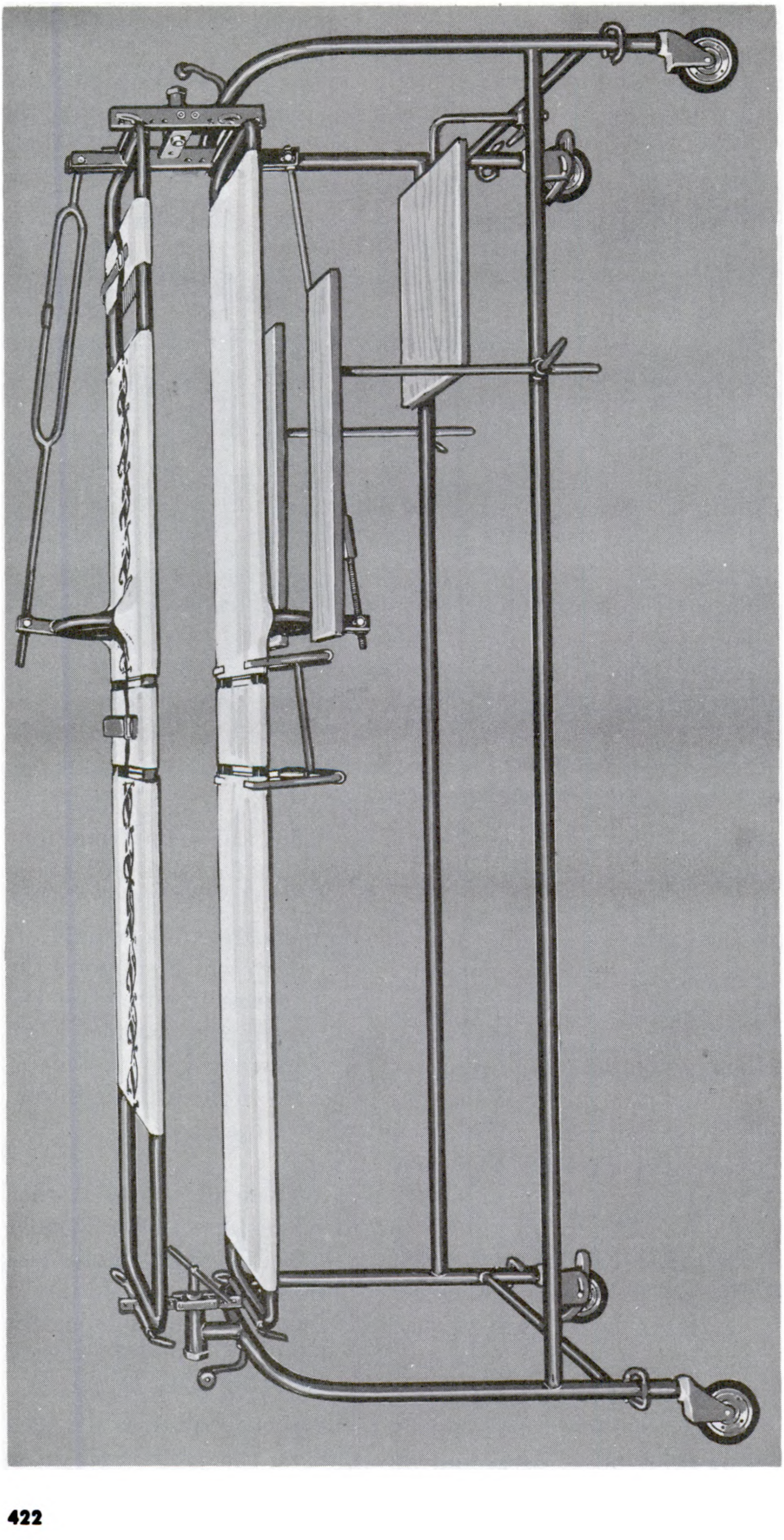


Figure 162. Foster reversible orthopedic bed.

the rod underneath the frame. Pull out the locking springs, warn the patient, and then quickly and smoothly rotate the frame toward you. Be sure the spring locks catch. They must then be securely locked. You may now remove the top frame and replace the round nuts on the pivots. Attach added supports and drainage tubes. Place a small pillow under the patient's head, if allowed, and replace arm boards and the footboard. Check the general body alinement and replace bedding.

(2) *From supine to prone.* Remove bed clothing and the small pillow under the head. Remove arm boards and place the patient's arms at his side; if he is paralyzed, place his arms slightly under the body. After placing pillows across the patient from his ankles to his chin, or securing the special mattress and sheet to the anterior frame, fit the frame down snugly over the patient and lock it in place (foot end first). Place the turning straps around the frames and proceed as in (1) above. Pull out the round locking pin at the center of each end. Turn the patient slightly and warn him that you are about to turn him over. Releasing the lock, turn the patient quickly. Although the frame will automatically lock itself, check to make sure that both ends are locked. Now release and remove the posterior frame. Replace the arm boards with pillows, if they are needed, and replace the bed covers.

d. Special Care of the Patient in a Turning Frame.

(1) *Management of the bladder.* A patient with a fracture of the spine or with cord injury presents a major nursing problem. Injury to the spinal cord is invariably accompanied by disturbances of the bowel and bladder. Spinal segments which control the reflexes of the bowel and the bladder may have been injured. Especially in the case of paraplegia, urinary sepsis is the primary cause of death. Sometimes an indwelling catheter is introduced; manual expression of urine every 4 to 6 hours is occasionally attempted. The problem of bladder management is always a major one in this condition.

(2) *Gastrointestinal complications.* Abnormal distension, another frequent discomfort in paralysis, may be relieved sometimes by hot applications or by the injection of drugs. If heat is used, you must take care that the applications are not too hot; the patient has sensory loss, and may not know that the packs are blistering him. Enemas must be given with extreme care; the intestine of the paraplegic patient distends very easily if too much liquid is given or if it is given too fast.

(3) *Bed sores.* Bed sores develop rapidly on the paraplegic patient. Frequent changes of position are imperative. Pressure sores in other conditions may be a problem, but in paraplegia the patient's life may depend on the treatment he receives to alleviate the condition. Death from infected bed sores can occur in a short time. A diet rich in protein and expert nursing care are necessary.

Section VI. CARE OF THE MENTALLY ILL

527. Mental Illness

Mental illness is a departure from normal thinking, acting, or feeling. Frequently the mentally ill person is limited in his ability to adjust to his environment and to adapt to new situations. His illness may be characterized by difficulty in his association with fellow patients or staff personnel by pecularities in his thinking or by periods of unpredictable or unusual behavior. Neuropsychiatric (NP) is the term used to describe a patient with this type of illness. Mental illness may occur in conjunction with or as a complication of a physical disease.

528. The Neuropsychiatric Team

The group of people who care for the mentally-ill patients in an Army hospital are called the Neuropsychiatric Team. This team is made up of doctors, nurses, psychologists, social workers, and enlisted specialists. Your role as an enlisted specialist on this team is a very important one, as you are the only member of the team who is constantly with the patient. You have a splendid opportunity to observe his behavior and reactions and report them to the nurse or doctor.

529. Importance of Proper Attitude

The most important single factor in the treatment of mentally-ill patients is the attitude of the people who care for them. Accept the patient and illness, recognizing that he cannot help and is not responsible for his illness. Observe his behavior without judging whether it is right or wrong. Treat each patient as an individual, not as a case. Reassure and encourage him. Use tact, understanding, and sincerity in all your dealings with him. Try to overcome any resentment he may have toward you or other hospital personnel. Praise and encourage him when he shows progress. Never argue with him. Explain to him the reason for doing things. Be firm, but avoid use of force. Use persuasion instead. Learn the names of the patients you care for and use their names when you speak to them. Never forget that the mentally-ill patient cannot help being ill, but that you and others can help him get well by your under-

standing and encouragement. When you are off-duty, never discuss patients, even with your coworkers.

530. Protective Care

a. Methods of Housing Mentally-Ill Patients. Two methods are employed in housing mentally-ill patients in an Army hospital. These are closed wards and open wards. Patients cared for on closed wards include those—

(1) Whose serious emotional disturbances necessitate hospitalization for further study and evaluation,

(2) Who require close observation by nursing personnel because of destructive feeling towards self or others, and

(3) Whose behavior occasions close psychiatric nursing supervision.

Open wards house psychiatric patients whose mental illnesses in convalescense require a further period of hospitalization of those whose psychiatric conditions initially do not warrant immediate closed ward care. These patients require a minimum of nursing supervision, can accept increasing responsibility for their own care and are encouraged to make many of their own decisions.

b. Purpose of Protective Care. Protective care is provided for mentally-ill patients to protect them from injuring themselves, other patients, or hospital personnel. All injuries, no matter how small, must be reported immediately to the head nurse or to the doctor. A notation of it is made on the patient's clinical record. A patient may have injured himself because he "heard voices" telling him to do so or he may feel that self-torture is necessary. The injury may be an attempt at suicide. Many suicidal attempts are made on impulse and without warning. All means by which a patient may take his life must be removed or safeguarded. He may try slashing his wrists or throat, for example, with glass obtained by breaking windows, glasses, dishes, bottles, mirrors. If any such item is broken, remove all broken pieces immediately. Be sure to account for all the pieces. Such articles as nail files, razor blades, knives, scissors, pins, nails, sharpened spoons, and pieces of metal can also be used to inflict injuries. The patient may try to hang himself with an electric cord, a tie, or with strips of bedding or clothing. He may also try to throw himself out of windows or from high places. The corpsman and specialist must be alert at all times to recognize potentially dangerous items and situations and prevent injury, if at all possible.

c. Prevention of Escape.

(1) Mentally-ill patients who are confined to closed wards frequently resent being "locked in" and make efforts to escape. They do not realize they are sick. They are confused and

disoriented. They may even "hear voices" telling them to escape. Some patients attempt to escape in order to get alcohol or narcotics. Others try it just to show that they can outwit hospital personnel.

(2) Try to make these patients as comfortable as possible within their restricted quarters. Know where each patient is at all times. Count them frequently, but do not let them know you are doing it. Know which patients have previously attempted to escape and watch them especially. Keep doors locked at all times and the keys attached to your clothing but not in view. Never jangle or play with keys. When you accompany patients off the ward, know and observe all hospital regulations. Always investigate restlessness among patients. If a patient is missing, *report it immediately*, and start a search for him.

531. Supportive Care

a. General. In addition to protective care, mentally-ill patients must be given supportive care. This includes daily patient hygiene, feeding, care of bowels and bladder, and any special nursing care ordered by the doctor.

b. Daily Patient Hygiene. Good personal hygiene is important for the mentally-ill in order to prevent disease and promote health and a sense of well-being. It includes care of the skin, nails, hair and mouth; adequate sleep and rest; attention to clothing and personal appearance; and elimination. Routines for personal hygiene and care of the mentally-ill are established just as for physically-ill patients. An opportunity should be provided for each patient who is able to take a daily shower. Close supervision must be given of bathing, oral hygiene, and care of the nails and hair. The standing operating procedure of the NP service hospital in regard to this should be closely followed. Patients who are not able or who refuse to care for themselves must be cared for by the ward personnel. Encourage patients to take pride in their appearance and to keep themselves neat and clean. See that their finger and toenails are cut short and are clean.

c. Feeding. The table method of feeding the patients is used as much as possible, and they are encouraged to eat a well-balanced diet. If a patient refuses food, report the fact and try to determine his reason. Mechanical feeding of mentally-ill patients is used only as a last resort, and should never be used as a threat to the patient.

d. Elimination. Regular bowel and bladder habits are encouraged by taking patients to the latrine at regular intervals. A daily record of elimination is usually kept, as neuropsychiatric patients may not be reliable sources of information themselves. Enemas and cathar-

tics are never given without a doctor's orders. Patients who are incontinent (unable to control bowel or bladder functions) must be given special attention and kept dry and clean. Any elimination problems a patient is having should be reported to the doctor or nurse.

532. Special Nursing Care

Patients who present problems in personal hygiene, in sleep and rest, in elimination, in feeding, or in behavior frequently require special nursing care. Elderly people in particular must be observed closely for bowel and bladder habits, for eating habits, and for personal hygiene. They have a tendency to forget. Patients who are overactive may also present a problem, as they are so "busy" that they have no time to attend to personal hygiene. On the other hand, underactive patients may not bestir themselves to observe good personal hygiene habits; they have to be encouraged. Along with their mental illness some patients also have physical illnesses which require special nursing care.

APPENDIX I

REFERENCES

AR 40–21	Medical Treatment Facilities.
AR 40–22	Organization of Class I United States Army Hospitals.
AR 40–101	Medical Care.
AR 40–108	Persons Eligible to Receive Medical Care at Army Medical Treatment Facilities.
AR 40–207	Individual Sick Slip.
AR 40–400	Individual Medical Records.
AR 40–403	Health Records.
AR 40–417	Morbidity Reports, Tables, and Charts.
AR 40–418	Beds and Patients Report.
AR 40–419	Outpatient Report.
AR 40–423	Recording of Anatomical Locations.
AR 40–424	Preparation and Maintenance of Clinical Records.
AR 40–425	Outpatient Medical Records.
AR 40–562	Immunization Requirements and Procedures.
AR 40–615	Pharmacy Management.
AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.
AR 611–201	Manual of Enlisted Military Occupational Specialties.
TM 8–244	Military Psychiatry.
TM 8–285	Treatment of Chemical Warfare Casualties.
DA Pam 8–13	Interpersonal Relationships in the Care and Management of Patients.
DA Pam 108–1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA Pam 108–2	Film Reference Guide for Medicine and Allied Sciences.
DA Pam 310–2	Index of Blank Forms.
DA Pam 310–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
DA Pam 310–7	Index of Tables of Organization and Equipment, Type Tables of Distribution, and Tables of Allowances.

TB Med 175	The Etiology, Prevention, Diagnosis, and Treatment of Adverse Effects of Heat.
TB Med 242	Health Hazards from Propellant Fuels and Oxidizers.
TB Med 246	Early Medical Management of Mass Casualties in Nuclear Warfare.
SR 40–1025–1	Basic Diagnostic Nomenclature of Disease and Injuries with a List of Surgical Operations.
SR 40–1025–2	Nomenclature and Method of Recording Psychiatric Conditions.
FM 8–5	Medical Service Units, Theater of Operations.
FM 8–10	Medical Service, Theater of Operations.
FM 8–50	Bandaging and Splinting.
FM 21–10	Military Sanitation.
FM 21–11	First Aid for Soldiers.
FM 21–40	Small Unit Procedures in Atomic, Biological, and Chemical Warfare.

APPENDIX II
MEDICAL TERMINOLOGY

1. Construction of Medical Terms

To understand most medical words, all that is necessary is to break the words into their parts and to know the meaning of these parts. Many medical words contain a stem or root to which is affixed either a prefix, a suffix, or both. A prefix is a group of letters combined with the beginning of a word to modify its meaning. A suffix is a group of letters added to the end of a word to modify its meaning. For example, the word "myocarditis" consists of the prefix "myo," the stem "card," and the suffix "itis." Myo means "muscle." Card means "cardiac" or "heart." Itis means "inflammation." Thus, myocarditis means inflammation of muscles of the heart.

2. Common Prefixes

arthro	joint.
auto	self.
contra	against, opposed to.
cyano	blue.
cyst	bladder.
derma	skin.
endo	within, inside.
entero	intestines.
epi	on, upon.
hyper	above, more than.
hypo	below, less than.
inter	between.
intra	within.
myo	muscle.
neuro	nerve.
ot	ear.
peri	around, surrounding.
procto	rectal.
pyo	pus.

3. Common Stems

cranium	head.
optic or ophthalmo.	eye.

otic............ ear.
hema........... blood.
osseous........ bone.
gastro.......... stomach.
hepatic......... liver.
renal............ kidney.
derm............ skin.
trauma......... wound.

4. Common Suffixes

a. Pertaining to Conditions of the Body.

-algia............ pain.
-cele............. tumor, swelling containing fluid.
-clysis........... slow injection of a large amount of fluid.
-itis.............. inflammation.
-phobia.......... fear, dread.
-plegia........... paralysis.
-rrhea........... flow, discharge.
-scopy........... inspection of the interior of an organ through an instrument.

b. Pertaining to Surgical Operations. Many of the terms that describe surgical operations are made by combining stems with suffixes. The stem or root word describing an organ is combined with a suffix describing the operation performed on it. Thus the word "tonsil" is combined with the suffix "-ectomy," meaning removal of, to make the term "tonsillectomy," meaning the operation for the surgical removal of the tonsils. Common suffixes pertaining to surgical operations are—

-desis............ surgical fixation by fusion.
-ectomy.......... removal of.
-lysis............. loosening from adhesions.
-ostomy.......... making a hole in.
-pexy............. to fasten.
-plasty........... to form, build up, repair.
-tome............. an instrument for cutting.
-tomy............. the operation of cutting, or incision.

5. Common Medical Terms

The following are common medical terms which are not defined elsewhere in this manual:

Adenectomy...... surgical removal of a gland.
Adenoma......... benign epithelial tumor with glandlike structure.
Adhesion......... abnormal joining of parts to each other.
Aerobic.......... living only in air or free oxygen.

Anaerobic -------- living without air or oxygen.
Analgesia --------- absence of sensitivity to pain.
Anastomosis ------ the joining of two vessels.
Aneurysm -------- sac formed by the dilatation of the walls of an artery or vein and filled with blood.
Anomaly --------- marked deviation from the normal standard.
Anoxemia -------- deficiency in the oxygen content of the blood.
Aphagia ---------- inability to swallow.
Appendectomy ---- surgical removal of the appendix.
Applicator -------- a tuft of cotton attached to a slender stick or wire.
Arrhythmia ------- irregularity in the rhythm of the heart beat.
Arthrodesis ------- surgical fixation of a joint by fusion of the joint surfaces.
Arthrolysis ------- operative loosening of adhesions in a joint.
Arthroplasty ------ plastic surgery of a joint.
Arthrotomy ------ surgical incision of a joint.
Ataxia ----------- lack of muscular coordination.
Bradycardia ------ abnormal slowness of heart beat.
Bronchoscopy ----- examination of the bronchi through a bronchoscope.
Calculus --------- abnormal concretion occurring within the body and usually composed of mineral salts—a stone.
Cataract --------- an opacity of the crystalline lens of the eye, or of its capsule, obstructing passage of the waves of light.
Cholecyst -------- the gallbladder.
Circumcision ------ removal of all or part of the foreskin of the penis.
Colectomy -------- excision of a portion of the colon or of the whole colon.
Colostomy -------- formation of an artificial opening into the colon.
Congenital ------- born with a person; existing at or before birth.
Cranioplasty ------ any plastic operation on the skull.
Craniotomy ------ surgical incision into the cranium.
Cyst ------------- any sac, normal or other, which contains a liquid or a semisolid.
Cystocele --------- hernial protrusion of the urinary bladder.
Cystoscopy ------- examination of the bladder with a cystoscope.
Cystotomy ------- surgical incision into the bladder.
Ecchymosis ------- discoloration of the skin.
Embolectomy ----- surgical removal of an embolus (blood clot).

Empyema	accumulation of pus in a cavity of the body, especially the chest.
Enterectomy	excision of a part of the intestine.
Enucleation of the eye.	surgical removal of the eye.
Enuresis	bed-wetting, involuntary discharge of urine.
Eschar	a crust of dead tissue, especially that occurring after a burn.
Escharotic	corrosive.
Fissure	any cleft or groove.
Fistula	a sinuous ulcerated tract often leading to an internal hollow organ.
Fistulectomy	surgical excision of a fistule.
Forceps	an instrument used to grasp an object.
Gangrene	death of tissues.
Gastrectomy	removal of the whole or part of the stomach.
Gastroenterostomy.	creation of an artificial passage between the stomach and the intestines.
Gastritis	inflammation of the stomach.
Gastrotomy	incision into the stomach.
Hemoptysis	the spitting of blood.
Hemorrhoidectomy.	surgical removal of hemorrhoids.
Hemostat	an instrument or a medicine for checking hemorrhage.
Hyperglycemia	excess of sugar in the blood.
Hyperpyrexia	abnormally high body temperature.
Hysterectomy	surgical removal of uterus.
Icterus	jaundice.
Incontinence	inability to restrain a natural discharge.
Induration	process of becoming hard.
Infarct	area of coagulation necrosis in a tissue, due to lack of blood supply to a part.
Keratoplasty	plastic surgery of the cornea.
Laminectomy	removal of the posterior arch of a vertebra.
Laparotomy	surgical incision into the abdominal cavity.
Ligature	a thread or wire for tying a vessel or a part.
Lobectomy	removal of a lobe.
Lysis	the gradual decline of a disease or the gradual return to normal.
Mastoidectomy	excision of the mastoid cells.
Metastasis	transfer of disease from one organ or part to another not directly connected with it.
Microscopic	pertaining to or visible only by the aid of the microscope.

Morbidity	a disease, sickness.
Myotics	medicines which cause contraction of the pupil of the eye.
Myoma	muscle tumor.
Nephritis	inflammation of the kidney.
Nephrectomy	surgical removal of the kidney.
Nephrolith	kidney stone.
Nephrosis	any disease of the kidney.
Neuroplasty	plastic surgery of a nerve.
Nocturia	excessive urination at night.
Occlusion	state of being closed.
Osmosis	the passage of a fluid through a membrane.
Osteoplasty	plastic surgery of the bones.
Parenteral	not through the alimentary canal.
Phlebotomy	incision into a vein.
Pneumonectomy	excision of lung tissue.
Precordial	pertaining to the region over the heart or stomach.
Proctoplasty	plastic surgery of the rectum and anus.
Prognosis	a forecast of the probable result of an attack of a disease.
Pruritus	severe or intense itching.
Ptosis	prolapse or falling down of an organ or part.
Resection	excision of a considerable portion of an organ.
Saphenous ligation.	ligation of the saphenous vein.
Splenectomy	excision of the spleen.
Stenosis	narrowing or stricture of a duct or canal.
Stricture	abnormal narrowing of a duct or canal.
Synovectomy	excision of a synovial membrane.
Tendoplasty	plastic surgery of the tendons.
Tenorrhaphy	surgical repair of the tendons.
Tenosynovitis	inflammation of tendon sheaths.
Tenotomy	incision into a tendon.
Thoracentesis	surgical puncture or tapping of the chest wall.
Thoracoplasty	operative repair of defects of the chest; plastic surgery of the thorax.
Thoracotomy	surgical incision of the chest wall.
Vesicle	small blister or sac containing liquid.

APPENDIX III
ABBREVIATIONS

1. Abbreviations Used in Preparation of Drugs.

Abbreviation	*Derivation*	*Meaning*
aq.	aqua	water
aq. dest.	aqua destillata	distilled water
conf.	confectio	confection
D.	detur	give
Dil.	dilutus	dilute
empl.	emplastrum	plaster
et	et	and
fl	fluidum	fluid
lin.	linimentum	liniment
liq.	liquor	liquid
lot.	lotio	lotion
mist.	mistura	mixture
pulv.	pulvis	a powder
syr.	syrupus	syrup
tinct.	tinctura	tincture
troch.	trochiscus	lozenge
ung.	unguentum	ointment
vin.	vinum	wine

2. Abbreviations Used in Dosage and Directions.

Abbreviation	*Derivation*	*Meaning*
aa	ana	of each
ad.	ad.	up to
Add.	adde	add to
ad. lib.	ad libitum	as much as desired
b.	bis.	twice
C.	congius	gallon
C.		centigrade
c̄.	cum	with
cc.		cubic centimeter
caps.	capsula	capsule
Contin.	continuetur	let it be continued
dim.	dimidius	one-half
div.	dividatus	divide
Ft.	fiat	let it or them be made
Garg.	gargarismus	gargle
gm.	gram	gram, grams
gr.	granum, grana	grain, grains

gtt.	gutta	drop, drops
IM		intramuscular
IV		intravenous
kg.	kilogram	thousand grams
l.	liter	liter
Lb., lb.	libra	pound
M.	misce	mix
mil.	milliliter	thousandth of a liter
min.	minim	minimum
O.	Octarius	pint
ocul.	oculus	the eye
o.d.	oculo dextro	in right eye
o.l.	oculo laevo	in left eye
o.s.	oculo sinistro	in left eye
o.u.	oculus uterque	in each eye
p.o.	per os	by mouth
q.s.	quantum sufficit	a sufficient quantity
R/	recipe	take
s.	sine	without
s.c., sub cut	sub cutem	subcutaneous
sig.	signa	label, let it be labeled
s.o.s.	si opus sit	if necessary
ss	semis	one-half
tab		tablet
tp	teaspoon	teaspoonful
tsp	teaspoon	teaspoonful
tbsp	tablespoon	tablespoonful
ʒ	drachma	dram
℥	uncia	ounce
℈	scrupulum	scruple

3. Abbreviations Indicating Time of Administration.

Abbreviation	*Derivation*	*Meaning*
a. c.	ante cibos	before meals
alt. hor.	alternis horis	alternate hours
alt. noct.	alternis noctes	alternate nights
b. i. d.	bis in die	twice a day
h.	hora	hour
h. s.	hora somni	at bedtime
m. et. n.	mane et nocte	morning and night
o. d.	omni die	daily
o. m.	omni mane	each morning
o. n.	omni nocte	each night
p. c.	post cibos	after meals
p. r. n.	pro re nata	when needed
qq. hr.	quaque hora	every hour
q. 2 h., q. 3 h. q. 4 h.		every 2, 3, or 4 hours
q. i. d., or 4. i. d.	quater in die	four times a day
stat.	statim	at once
t. i. d.	ter in die	three times a day

4. Abbreviations Indicating Hours of Administration.

The following is a list of the customary hours for administration of drugs when the instructions of the physician indicate only the number of doses to be given each day.

q. i. d	0800, 1200, 1600, 2000
q. 2 h	0600, 0800, 1000, 1200, etc.
q. 3 h	0900, 1200, 1500, 1800, etc.
q. 4 h	0800, 1200, 1600, etc.
q. 6 h	0600, 1200, etc.
b. i. d	1000, 1600
t. i. d	1000, 1500, and 1800
a. c	½ hour before meals: 0630, 1230, 1630
p. c	0800, 1400, 1800

INDEX

[AG 353 (28 Nov 60)]

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For explanation of abbreviations used, see AR 320–50.

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